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EDITORIAL

Bulk Shipment of Palm Oil.

During the early stage of the development of the palm oil industry in Malaya, when the area in bearing was small, the amount of palm oil produced was insufficient to render feasible its export in bulk.

Producers were compelled to import barrels which were assembled on the estates and rendered suitable for containing palm oil.

The very considerable expense entailed by the import of barrels directed attention to the possibility of employing Malayan timber for this purpose. One oil palm estate, to our knowledge, experimented in this direction for some time but eventually abandoned the idea chiefly, it is thought, on account of the difficulty in obtaining sufficient quantities of more suitable timbers and to the local lack of knowledge coopering.

The satisfactory prices obtained for palm oil, however, rendered the export of palm oil in imported barrels remunerative, although planters looked forward to the time when bulk shipments would become possible.

During the past two or three years the export of palm oil from Malaya has steadily increased. In 1929 it amounted to 1,831 tons, in 1930 to 3,211 tons, while it is expected that the exports of 1931 will approach 4,000 tons.

Our Dutch friends in Sumatra, possessed as they are with a larger area of oil palms in bearing, (the figures at the end of 1930 were 74,000 acres in bearing and exports for the year of 47,258 tons of oil), have already inaugurated bulk shipping of their oil and it occurs to us that it is high time that the Malayan palm oil interests should consider this subject.

In the present number, an account is given of the first bulk shipment of palm oil from Malaya. This was undertaken by a firm with very extensive oil palm interests in Malaya, so that the amount of their present produce evidently justifies their action. But there are in Malaya, a number of estates of less area that individually will never be in a position to ship oil palm in bulk, but should derive considerable benefits by the innauguration of a service in which they with others could participate.

The article in this number, which could not have been written without the facilities which the Socfin Co. Ltd. offered to the author, may not only direct attention to the importance of this subject, but may serve as a guide to the method by which bulk shipments of oil from this country may be systematised.

Padi Experiments. Investigations on padi problems are assisted very little by the work of a similar nature with other crops, by reason of the fact that padi is grown in water, and necessarily adapts itself to this habitat. It is to be expected, therefore, that its behavior to variations in conditions finds no parallel in other crops. Research on the problems of cultivation, planting methods and manuring for instance, can find but little assistance from similar work on dry-land crops, while pre-conceived ideas on the subject are apt to prove most misleading.

In Malaya, padi experiments and the application of the results have engaged the attention of the Department of Agriculture almost since its inception and from the investigators, through both the European and Asiatic field Staff, the results of the work are being demonstrated and made available to the individual padi planters throughout the country.

The progress of the work may be visualised from the summary of the experiments which is included in this *Journal.*

Although valuable results have been obtained from these investigations it is not contended that finality has been reached. The solution of one problem frequently reveals further problems to be solved. Manurials experiments are being conducted on lines reorganised in the light of previous unsuccessful experiments, breeding work is in its infancy and the effect of soil and water gases, of bacteria and protozoa is as yet but imperfectly understood although the importance of each becomes increasingly evident.

The work of minimising losses of crops by reason of stem-borer attacks is a specialised problem of which mention is made in this article. A complete account of research work in this direction will be the subject of a special report to be published at a later date.

The Preparation of Organic manure. The increasing importance of stock raising in Malaya gives point to the article on another page on investigations on the preparation of organic manures. The object of this work is rapidly to break down waste organic matter, such as grass cuttings, by the admixture of farmyard manure. The latter inoculates the grass with micro-organisms capable of decomposing the grass cuttings or other organic matter and so rendering it of greater utility for manurial purposes.

These preliminary experiments shew that this breaking down process is capable of achievement within seven weeks. The writer points out that the usefulness of the resultant material is intricately bound up with content, assimilation, conservation and loss of nitrogen and the chemical constitution of the original materials.

Cultivation of Cloves.

The article on this subject included in this number, records the results obtained at the Government Experimental Plantation, Serdang. The evidence brought forward refutes the usual assertion that cloves will only flourish within sound of the sea. In the past, Malaya has produced a quality of cloves second to none in the world, and there appears to be no good reason why the country should not be able to regain her supremacy in this respect.

The times are, perhaps, not advantageous for inaugurating a large industry in cloves, and at the best of times the market for this commodity is easily overloaded. On the other hand, there is no reason why this crop should not be included in mixed plantations and be more generally planted by those who have small areas of suitable land at present undeveloped.

Ourselves.

With the present number we conclude the nineteenth volume of *The Malayan Agricultural Journal,* which constitutes the second year of publication in its present form.

Although the circulation of this *Journal* is steadily increasing and its influence becoming more widely recognised, it is to be regretted that there are still a large number of planters in Malaya who do not read the *Journal.* It has been stated too, that in some cases, those responsible for the finances of estates do not allow the small annual charge of $5 to be put through the estate accounts. We regard this as a retrograde policy, for it appears to us increasingly important in times of depression that the planter shall be conversant with the progress of science as applied to his industry.

The Department of Agriculture is the servant of the public and in particular, of the agriculturist. The *Journal* is designed to bring the Department more closely in touch with the agriculturists which it is intended to serve. It is hoped that Agency firms and Directors of Companies will assist this Department by the provision of these publications to the estates in which they are interested.

Original Articles.

BULK SHIPMENT OF MALAYAN PALM OIL

BY

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Introductory.

A further stage in the oil palm industry of Malaya was reached on October 18th 1931 when the first bulk shipment of palm oil, amounting to approximately 102 tons, was made from Kuala Selangor by the Straits Steamship, s.s. "Krian," *en route* to Belawan, a second shipment of approximately the same amount being made a week later.

This development is due to the initiative of the Socfin Co. Ltd. who, as the pioneers of bulk shipment in Sumatra, have now decided to extend this method to their oil palm estates in Malaya.

Since the output from their estates in this country is, however, at present insufficient to warrant the erection of the necessary installation and allow of loading direct into ocean-going steamers, arrangements have been made with the Straits Steamship Co. to transport the oil to Belawan, where the Socfin Co. Ltd. have a large tank installation and the oil can be bulked with other palm oil of similar quality from their Sumatran estates.

The adoption of such a procedure has enabled the Company to overcome the great difficulty now encountered when commencing the bulk shipment of oil, namely that buyers are either reluctant to accept separate consignments of less than 800 tons; or in the case of smaller consignments 400 or 500 tons, offer a price less than the prevailing market quotation, consequent upon the extra trouble involved in dealing with a relatively small shipment.

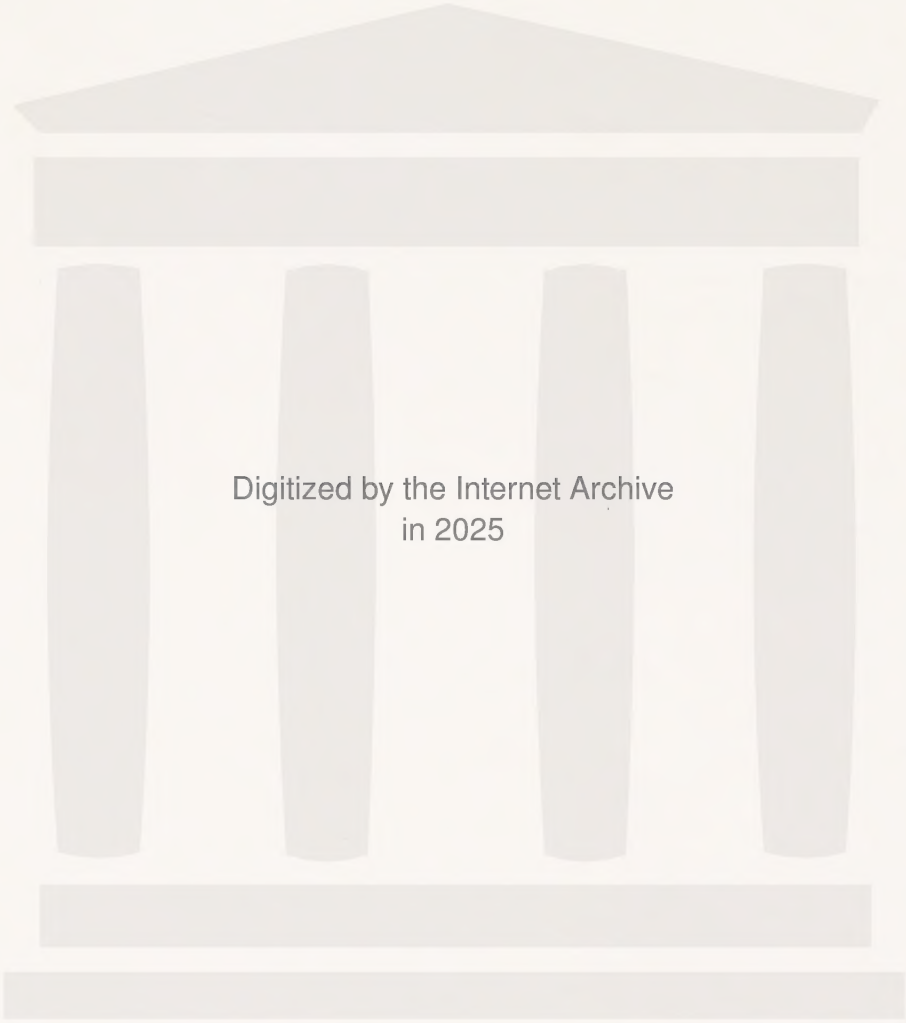
It must be realised, however, that the present arrangement is only temporary as the Socfin Co. Ltd. contemplates, probably in two or three years time, the erection of a large storage installation at one of the Malayan ports, loading of the oil being made then direct into the ocean-going steamer.

The Straits Steamship Co. have therefore installed in one of their ships, s.s. "Krian," storage tanks with the requisite pumping installation and the present arrangement is that this ship, which is on the Penang—Telok Anson run, calls at Kuala Selangor for palm oil, when there is sufficient to warrant shipment.

On the occasion referred to above, the oil came from Sungei Tinggi Estate, situated some 40 miles by river from Kuala Selangor, and three transhipments were therefore involved on account of the fact that only shallow draught barges can be used for the river journey.

In spite, however, of the relatively small amount being shipped and the fact that some of the present arrangements are also only temporary, it is thought

Pumping Palm Oil from Lighter to Ship.



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that a general description of the method will be of interest, especially as it is hoped that with the steady increase in the output of the oil from the country more estates will decide to ship in this manner.

Method of Shipment.

The purified oil from the De Laval separator is delivered into a tank waggon, having a capacity of 1½ tons. The waggon is mounted on rails and pushed from the factory to the river bank, a distance of approximately ¾ mile, where the storage tank is erected. The waggon is connected to the tank with a length of flexible hose and the oil transferred by means of a hand-operated pump.

The capacity of the storage tank is approximately 100 tons. Such a relatively large tank was considered necessary in view of the fact that at various times in the year there may be insufficient water in the river to permit of the shallow draught barges making regular trips between the estate and the loading station for the lighter, and it is essential therefore to have a reserve of storage accommodation for the oil at the factory.

It may be mentioned here that the present method of transporting the oil from the estate factory by tank waggon is temporary; later it is hoped to install a pipe line direct to the storage tank.

The latter is provided with closed steam coils for heating the oil, if necessary, when delivering to the river barges, which come alongside and into which the oil is fed by gravity.

The river barges are fitted with two tanks, each having a capacity of 8 tons, making a load of 16 tons of oil per barge. The latter when loaded are towed down the river to Kuala Selangor, where the lighter is at present moored, the distance from the estate being, as mentioned previously, approximately 40 miles.

The tanks on the river barges are fitted with hand operating pumps capable of delivering 5 tons of oil per hour, the oil being pumped direct into one of the tanks on the lighter. A closed steam coil, which can be lowered into the tank, is available, if necessary for heating the oil. So far, however, no difficulty has been experienced in transferring the oil.

The total tank capacity of the lighter is approximately 230 tons, divided between six tanks, two forward, each of 30 tons, two amidships, each of 50 tons and two aft, each of 35 tons.

A donkey boiler, capable of maintaining a steam-pressure of 70 lbs., is fitted aft to provide the necessary steam for heating the oil and pumping. Each tank is fitted with a closed steam coil for heating purposes, while live steam is also available for cleaning the tanks when necessary. A 6 inch pipe is fitted for pumping the oil, which can be delivered at the rate of 65 tons per hour. Each tank is also provided with a separate valve to connect with the main pipe line.

The lighter is at present used as a storage tank and when sufficient oil has accumulated to warrant shipment, the lighter is towed out and moored alongside the s.s. "Krian," which anchors at sea about 2½ miles beyond the bar off Kuala Selangor.

The tank capacity of this ship is approximately 102 tons, divided between four tanks, two of the tanks each having a capacity of 40 tons, the other two each of 11 tons. The pumping installation on board comprises both suction and delivery, this dual arrangement facilitating considerably in the even filling of tanks, while the suction arrangement is especially useful for removing all oil from the pipe line on the completion of pumping.

The pipe line on the lighter is connected by means of 6 inch flexible hose with the installation on the ship and the oil which has previously been heated to approximately 110°F. is pumped from the lighter into the ship's tanks. When the level of oil in a tank is within one foot of the top it has been found advisable to change over from the pump on the lighter to the suction pump on the ship. This change enables a better control of oil at the finish, avoiding overflow with consequent wastage of oil.

The s.s. "Krian" conveys the oil to Belawan, where it is pumped into one of the 530 ton tanks of the installation and stored until sufficient has accumulated to warrant shipment by an ocean-going steamer.

At present the greater proportion of the oil shipped in bulk from Sumatra is imported into the United States of America, although it is understood that some of the larger European ports dealing in palm oil, notably Liverpool, are contemplating the erection of the necessary plant to deal with bulk shipments of oil on arrival.

Remarks and Conclusions.

Apart from the question of the most economical method of handling the oil from the factory to the ocean-going steamer, shipment in bulk also raises questions regarding the bulk measurement of oil of different acidities at varying degrees of temperature. Determination of the viscosity of the oil at varying temperatures must also be made, so that the best temperature for pumping can be ascertained having regard both to the rate of flow of oil and the necessity for avoiding heating of the oil to a temperature that may affect its quality. Work on these lines is being initiated.

The writer, who was present on the first occasion of shipping the oil, is indebted to Mr. I. Sibiriakoff of Sungei Tinggi Estate, who was in charge of the shipment of the oil, for most of the details in the description of the method of shipment.

THE EXPERIMENTAL CULTIVATION OF CLOVES.

BY

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Introductory.

In a previous article the history, cultivation, and preparation for market of cloves in Penang and Province Wellesley was published (*Malayan Agricultural Journal*, Vol. XIX, page 4). In the present paper, it is proposed to record the results obtained with this spice crop at the Experimental Plantation, Serdang, Selangor, since the growth of the trees and yields have so far been very satisfactory.

It is generally considered that the clove tree (*Eugenia caryophyllata*, Thunb) will not thrive at any great distance from the sea. Ridley refers to this and states that clove trees in Penang obstructed from the sea-air by the configuration of the surrounding land, soon became badly affected with the "red-spot" disease (*Cephaleurus mycoidea*, Karsten) and subsequently died (*Spices*, 1912, page 173). The Experimental Plantation, Serdang, is approximately 25 miles from the Kuala Langat coast, which is the nearest open sea. It is, therefore, a matter of considerable interest to ascertain whether the present efforts to grow cloves so far inland will continue to be successful as the trees mature.

Propagation.

The usual method of propagating cloves is by sowing the seeds in shaded beds of prepared soil. At Serdang, success is obtained by sowing the freshly gathered fruit in boxes containing well-drained soil under heavy shade.

As in generally known, the cloves of commerce consist of the unopened flower buds of the clove tree. After flowering, the lower part of the flower together with the calyx swells and develops into a fleshy, one-seeded drupe, purple in colour and about 1 inch long. The period between the opening of the flower and ripening of the fruit is about 2½ months.

The fruits are spaced about one inch apart and pressed half an inch into the soil in a horizontal position. Germination takes place in one month from sowing and, provided the fruits have not become damaged by heating, 75 per cent. germination or more is commonly obtained. When the seedlings have two to three pairs of leaves they are carefully lifted from the seed boxes and transplanted into bamboo pots. The soil employed contains a large proportion of humus with the addition of sharp sand to ensure adequate drainage. The bamboo pots containing the seedlings are then placed on a firm surface under the shade of 'ataps' which are raised five feet from the ground to allow for watering. As the seedlings age, the shade is partially removed with the object of gradually

hardening off the young plants preparatory to planting in the field. Considerable care is necessary in watering as the clove tree is intolerant of excessive soil moisture during all stages of its growth. Should drainage be inadequate the seedlings lose their leaves and cease growing. With suitable treatment, the young plants attain a height of six inches within six to eight months from germination, and carry about ten pairs of leaves. The seedlings are then ready for planting in the field.

It may be mentioned here that investigations are now being undertaken to determine whether it is possible to propagate the clove tree by layering the lower branches. In addition, several indigenous species of Eugenia have been established, but so far, attempts to graft or bud scions on to the wild stock have proved unsuccessful.

Planting.

The planting distance adopted is 20 feet by 20 feet triangular, allowing 124 trees per acre. In order to encourage the plants to make rapid growth and become established early, holes 2 feet by 2 feet square and 2 feet deep are dug. The sub-soil is removed and replaced by a mixture of well-rotted cattle manure, or other organic matter, and surface soil. After planting, the seedlings are shaded with jungle herbage placed securely round the plant. The most satisfactory planting season is October/November, which avoids the possibility of the plants receiving any check owing to drought. Even with the greatest care, considerable difficulty is experienced in establishing a complete stand of trees and consequently frequent supplying is necessary. During the short wet season, culminating in April, the planted area should be examined and all vacancies supplied with further seedlings.

Cultivation.

At Serdang, the original area was planted with cloves in March, 1923 and was about 4½ acres in extent situated on the lower slope of a hill-side facing east. The soil belongs to the quartzite type being a yellow clay loam with some underlying laterite. As the silt-pitting system was found to be inadequate, contour bunds were dug in 1929-30. Subsequently, a further 3 acres were planted in October, 1930. Trenches 2 feet by 2 feet were dug along the contours with 2 foot stops every 30 feet, the spoil being placed on the lower side of the pit. In order to bind the bunds together the soil was first beaten down and then cuttings of vetiver grass, *Vetiveria odorata*, were planted along the top of the bunds 1 foot apart. Vetiver grass is to be recommended for this purpose since it does not spread laterally by means of stolons or runners and so get out of hand, while its vigorous root system tends to bind the soil.

Owing to the fact that the clove tree tends to form a mat of roots just below the surface of the soil, experience has caused two points to emerge. Firstly, competition from vegetation such as cover crops or weeds in the immediate vicinity of the bush is not desirable; secondly, root wounding or dis-

Clove tree 2 years old
Height 5 feet.

Mature Clove tree 8½ years old
Height 16 feet

turbance during weeding operations is not tolerated. It is usual in Penang to cultivate the clove tree exposed to full sunlight. In Zanzibar, a light shade obtained by planting *Adenanthera pavonina,* a small leguminous tree, is commonly employed. With the object of obtaining information on this point, half of the area under cloves at Serdang was interplanted with *Adenanthera pavonina.* The shade trees were interplanted between the rows of cloves at a distance of 20 feet by 20 feet. As far as can be ascertained at present the light shade appears beneficial although no improvement in yield of cloves is evident.

The importance of manuring the clove tree has been stressed by previous writers and experience at Serdang bears out fully this recommendation. Individual treatment of trees is necessary rather than sterotyped treatment of the planted area.

Young bushes respond well to an annual application of ammonia dug into the soil in a circular trench sufficiently far from the tree not to disturb the roots. At Serdang, a dressing of 3 ounces of this fertiliser per tree has resulted in considerably increased growth when compared with bushes receiving no manure. Cattle manure, or other well-rotted organic refuse, may be applied with advantage as the trees mature. The organic matter employed should in all instances be dug into the soil some distance away from the main surface roots of the trees.

Growth.

Measurements of the annual growth of twenty clove trees planted during March, 1923 have been taken since January, 1928 and the following figures show the annual rate of growth for the period 1928—1931 :—

Year.	*Height.*	*Spread.*
1928	8 ft. 0 ins.	5 ft. 10 ins.
1929	9 ft. 11 ins.	7 ft. 2 ins.
1930	14 ft. 7 ins.	10 ft. 6 ins.
1931	15 ft. 6 ins.	11 ft. 9 ins.

In June, 1931 these trees were examined and the average girth of the trunk one foot above ground level was found to be 1 foot 5 inches.

Yields.

The period between planting and flowering was from March, 1923 till June, 1927. A small crop was harvested during 1928 although insufficient to warrant yields being taken.

During the year 1930, the individual yields of 20 trees including the green weight of the fresh cloves and their residual weight when dry have been recorded. Cropping takes place from January to August with the heaviest yield during May and June. The following crop was harvested from 20 trees during 1930 :—

Weight of Green Cloves.	*Dried Cloves.*
230 lbs.	68 lbs.

This given an average yield per tree of 3.4 lbs. of dry cloves for the year. Allowing 124 trees per acre and 70 per cent. of these in bearing, a yield of about 310 lbs. of dry cloves per acre from seven-year-old trees may be obtained. According to Ridley (*Spices* l.c.) the average yield for mature trees in Penang was 5 lbs. of dry cloves per annum. The trees at Serdang are as yet comparatively young and should be capable of higher yields as they mature.

The freshly collected cloves are dried in the sun on a concrete barbacue for seven days. In order to ascertain the loss of weight on drying, four samples of green cloves consisting of 200 each were weighed immediately after harvesting, dried on the concrete barbacue for seven days and again weighed. The following table records the results obtained:—

Sample.	*Green Weight.*	*Dry Weight.*	*Percentage Dry Weight.*
200 cloves.	61 grams	18 grams	29.50 per cent.
200 ,,	59 ,,	17 ,,	28.85 ,,
200 ,,	58 ,,	17 ,,	29.30 ,,
200 ,,	61 ,,	18 ,,	29.50 ,,
Average.	59.8 ,,	17.5 ,,	29.29 ,,

It will be seen, therefore, that a loss of weight of about 70 per cent. results upon drying.

Market Prices.

The average market price at Singapore for both Amboina and Zanzibar cloves for the first half of the year 1931 was well over $50/- (Straits currency) per picul. (1 picul = 133⅓ lbs.) Recently, prices have declined, the market at Singapore for September, 1931 being quoted as Amboina $48/- and Zanzibar $43/- per picul, respectively. Produce obtained at Serdang has been readily saleable locally during the year at prices ranging from $55/- to $50/- per picul. Although the Penang clove has always been considered superior to that from other countries there is little or no market with Europe for local produce at the present time.

Conclusions.

Experience at the Government Plantation, Serdang, demonstrates that cloves, contrary to popular belief, will succeed inland, provided that the trees have the advantage of good natural drainage. Cloves of excellent quality are produced and are readily saleable.

Trees commence bearing during the fifth year from planting in the field. Young trees in the second year of bearing yield about 3½ lbs. of dry cloves per season or approximately 2¼ piculs per acre per annum.

The loss of weight of prepared cloves at Serdang calculated on the fresh weight of unopened buds is about 70 per cent.

PADI EXPERIMENTS IN MALAYA, 1930-31.

Part I. selection, breeding, cultivation and seed distribution.*

The season 1930—31 was notable in that cultivation operations were delayed in all the larger areas by the exceptionally prolonged drought which was general throughout the country in the middle of 1930. Despite the late start, the rainfall was fairly well distributed and bumper crops were garnered in the large northern areas generally, quite good crops being obtained elsewhere throughout the country.

The season was also remarkable for the large numbers of rats which were encountered everywhere and the wide spread of damage due to stem-borers.

The present serious depression in prices of our chief export commodities has, in spite of heavy local crops and very cheap imported rice, caused cultivators to give serious thought to local production and drawn unusual attention to the needs of the local rice industry.

In the season 1929—30 experiments were in progress at two Stations and twelve smaller Test Stations had been established in the more important padi-growing areas. Since then, one new Experiment Station has been organised at Teluk Chengai by the Kedah Government and five new Test Stations have been established in suitable localities and were cropped in the last season, while it is probable that five or six more Test Stations may be established in the coming season.

The experimental work during the last season embraced selection and breeding experiments, centred at Titi Serong (Krian) and Pulau Gadong (Malacca), manurial experiments, and fields trials of the comparative productive abilities of various pedigree strains in numerous Test Stations. Also, in certain areas where they were deemed advisable, preliminary cultivation experiments of a simple nature were made. Experiments at Taiping in reclaiming mining land for padi cultivation, and researches on methods of pest control, particularly stem-borers, in Krian, were continued. Meteorological records of rainfall, temperature, etc., likely to provide information useful to agriculture, were maintained at Titi Serong, Pulau Gadong and Teluk Chengai Stations, and in all padi areas, vigorous rat destruction was instrumental in killing over 3,380,000 rats during the season.

Selection.

Selection experiments have been continued at Titi Serong and Pulau Gadong Experiment Stations and are chiefly concerned with the four popular varieties—Seraup (7—8 months), Radin, Nachin and padi Siam.

Trials of selected strains of these varieties, isolated on account of desirable qualities on adaption to special local conditions, were made at various test stations and multiplication or observation plots throughout the country. These trials, besides indicating the most suitable varieties for local conditions, serve

* Compiled from Departmental records by H. W. Jack, Economic Botanist.

as multiplication-centres for seed supplies of such varieties and at the same time, are of value as demonstrations to local cultivators who are enabled to see their own unselected types growing side by side with selected strains of superior value.

The best results are indicated in tables 1 and 2.

Table I. Results at Experiment and Test Stations.

Area.	Selected Strain.		No. of 1/40 acre plots.	Control variety.	Average yield per acre in gantangs.		Present. increase over control.	Significance.
					Selected.	Control.		
T. Serong	Seraup	36	12	Seraup	354±14	318±13	11	Not decisive.
,,	,,	48	12	,,	336±11	,,	6	,,
,,	,,	Mix	3	,,	346±15	,,	9	,,
,,	Radin	2	12	Radin	288±11	262±16	10	,,
,,	,,	4	12	,,	272±22	,,	4	,,
P. Gadong	Nachin	10	5	Nachin	323±13	258±22	25	Positive.
,,	Siam	29	5	Siam	321±16	225±14	43	,,
,,	,,	76	5	,,	292±17	,,	32	,,
,,	,,	18	5	,,	277±11	,,	23	,,
A. Gajah	Siam	4	7	Siam	330±14	260±4	27	Positive.
,,	,,	29	8	,,	400±26	,,	54	,,
,,	,,	78	6	,,	350±24	,,	35	,,
Glugor	Seraup	36	10	Sekapoy	321±22	248±18	29	Positive.
,,	Radin	4	10	,,	288±16	,,	16	Not dec.
,,	Seraup	15	10	,,	316±23	,,	29	Posit.
Talang	Radin	4	10	Radin	517±18	378±29	36	Positive.
,,	,,	2	10	,,	459±29	,,	21	Not dec.
,,	,,	13	10	,,	464±26	,,	23	,,
,,	F. S.	27	10	,,	433±31	,,	12	,,
Lenggong	Seraup	36	10	Seraup	711±54	582±43	24	Not dec.
,,	,,	15	10	,,	699±35	,,	20	,,
,,		1	10	,,	664±45	,,	14	,,
,,	Radin	2	10	Radin	640±37	309±30	107	Positive.
,,	,,	1	10	,,	568±48	,,	93	,,
Kuang	Seraup	36	8	Padi Putch	332±21	300±34	11	Not dec.
Dong	Seraup	36	3	Jambak Bawang	430±21	327±20	31	Positive.
,,	Radin	7	3	,,	410±10	,,	25	,,
,,	,,	13	3	,,	420±17	,,	28	,,
,,	,,	2	3	,,	373±14	,,	14	Not dec.
,,	Serendah	875	3	,,	370±32	,,	13	,,
,,	Seraup	48	3	,,	390±21	,,	19	,,

As can been seen in Table I, many of the results are positively significant, the remainder being materially better than the controls but not decisively so, probably, at least in some areas, due to damage by rains before harvest. The range by which significance is judged has been taken as twice the amount of the standard error above and below the average yields per acre in comparison with similar range of error for the controls.

At Titi Serong, the harvest was very late and suffered severely from the March rains, so that differences have been reduced substantially; nevertheless Seraup 36 and Radin 2 maintained their good yielding reputations. As regards the results at Pulau Gadong, each trial plot was only 0.0045 acre in area but the plots were grouped together into small compact blocks to reduce variation due to soil and water conditions. In this area and in Alor Gajah, Siam 29 is outstanding for yielding capacity, has a stout straw and gives good eating rice although of poor milling quality. In all other areas, the trial plots were constantly 1/40 acre in area and in practically every case, the same number of randomised plots were used in calculating the yields of control varieties as of the selected strains. At Glugor, floods damaged the crops considerably, but Seraup 36 again demonstrated its superiority. At Talang, Radin 4 proved a surprise in outyielding Radin 2 which has given such good crops in previous seasons. At Lenggong, the Radin control plots suffered severely from rains just before harvest which vitiated the results accordingly, making the selected Radins appear excessively good in comparison. Seraups 36 and 15 gave the best yields. At Dong Seraup 36, Radin 7 and Radin 13 gave excellent crops, but Radin 13 will probably be the favourite as an eating rice. The standard test station at Bukit Merah in Province Wellesley was the only station at which better yields were recorded from unselected seed than from selected seed in last season, when unusually good crops were harvested in the neighbourhood of this station, but even there, strains Radin 2, Seraup 36 and Seraup 15 impressed the cultivators for their good crops and stout straw, and in consequence, some applications for seed were received. The selected Seraup strain at this station showed higher tillering than the controls, but they suffered more from the rains at harvest than the control type because of their longer maturation periods.

At Titi Serong and Pulau Gadong Experimental Stations, the isolation of further strains of the varieties already mentioned was continued and in addition, strains of a number of other popular and promising varieties were included in last season's planting programme.

Among the new varieties subjected to selection methods, mention may be made of Mayang Ebos, Kunchor and Riong as promising types for cultivation in Province Wellesley, North Kedah and Perlis and of Padi Chubai which has distinct possibilities in areas affected by brackish water.

Attention has also been given to early maturing types, suitable for areas where water supply is scanty, and of these types Radin Siak, Padi Acheh and several strains of Serendah are promising and produced good crops in certain areas last season.

As different strains are required to suit different padi areas, it is necessary to maintain pure stocks of several strains of each leading variety, particularly of the 6-month varieties which have a wider distribution than the longer maturing types; hence, pure cultures of 10 Seraup strains, 6 Radin strains, 4 strains of padi Siam, 4 Nachin strains and numerous other less important strains in which cross-pollination was prevented by bagging, were maintained at Titi Serong Station.

Furthermore, a collection, representing all the chief varieties grown in Malaya, is maintained at that Station and promising types are isolated and tested against standard strains in replicated plots.

In last season, 16 types isolated from this collection were tested against Seraup 36 and five of them produced crops approximating to that of the standard strains and will be further tested next season.

In addition to trials of selections in Test Stations in the main padi areas, subsidiary trials were also conducted in several observation and multiplication plots scattered throughout rice-growing areas, and the better results obtained in these plots are summarised in Table 2.

The results in Table 2 need little amplification and indicate outstanding yields from Seraup 36 at Kuala Kurau, Budu and Sabui. Radin 13 was prominent at Tanjong Besar and Jelebu; at Penjom, Serendah 875 gave a considerable increase over the controls, and Radin 2, for the second year in succession, gave greatly superior crops at Semanggol. The last season was a late one, but nevertheless, suitable strains for several areas seem to be indicated by the results obtained, through all trials will be repeated for three seasons before definite conclusions are formulated. Many of these observation stations are situated in the Raub District of Pahang, in which it has been estimated that 70 per cent. of the padi planted is derived from selected strains distributed in the last few years with a consequent beneficial effect on the District padi production.

In addition to the results shown in Tables 1 and 2, appearances were such as to justify the supposition that selected strains yielded better crops than local types in many other instances, but misfortune in the way of pests and adverse weather have precluded statistical proof of the results, and in some areas (Pekan and Temerloh) the crops were entirely destroyed by floods.

Mixture of Selected Strains.

Two mixtures comprising (a) the four best Seraup strains and (b) the four best Radin strains were grown at Titi Serong in quadruplicate plots of 1/80 acre each and produced good crops, but records of yields were only taken from the Seraup plots because the padi in the block in which the Radin plots were grown was badly damaged by stem-borers and by rats. Observations last season, coupled with records in the previous season, indicate promise of useful results from mixtures of good strains and the experiment will be repeated in the coming season.

Table II. Results at Observation Stations.

Area.	Selected Strain.		No. of 1/40 acre plots.	Control variety.	Average yield per acre in gantangs.		Percent. increase over control.
					Selected	Control.	
PERAK.							
K. Kurau	Seraup	36	6	Achch	504±24	385±19	31
„	Radin	11	6	„	450±20	„	17
„	„	7	6	„	426±33	„	11
B. Serai	Seraup	48	4	Radin	235±4	202±6	16
„	Radin	2	9	„	223±8	„	10
P. Buntar	„	2	10	„	423±14	358±19	18
„	„	4	6	„	388±11	„	8
Semanggol	„	2	10	„	249±10	151±18	64
PERLIS							
Arau	Seraup	36	6	Local 8 months.	446±13	413±27	8
„	Radin	2	6	Radin	461±27	460±21	12
Salang	Seraup	36	6	Av. of 4	495±15	„	8
„	Radin	2	6	4 vars.	473±16	„	3
KEDAH							
T. Chengai	Radin	2	Single	Average	347	337	3
„	Siam	29	large	of four	360	„	7
„	Nachin	10	plots	varieties	402	„	19
F. M. S							
Kajang	Radin	2	5	P. Kuala	157	140	12
Penjom	Serendah	875	8	Local	560	405	38
Telang	Seraup	15	3	„	660	560	18
Budu	„	36	3	„	680	540	26
T. Besar	Radin	13	3	„	680	520	30
B. Talam	Seraup	36	3	„	740	640	15
Bentong	„	36	3	„	520	440	18
Sabui	„	36	3	„	500	400	25
Sega	Radin	13	3	„	740	665	11
Semantan	„	13	2	„	560	500	12
Jelebu	„	13	4	P. Trong Kechil	359±66	286±13	26

Breeding.

Ten very robust hydrid plants representing crosses between Seraup 36, Radin 2 and F 27 (Nachin Rembau), with an usually high tillering (approximately 40 tillers per plant) were harvested.

Each of these heavy-yielding strains possesses desirable characters, and combinations between them should produce useful results in the next season. Further desirable crosses will also be made next season since a satisfactory technique has now been established.*

In an experiment to investigate the amount of natural cross-pollination which may occur under Krian condition, four very distinctive types of padi of the same maturation period were grown in closely planted adjacent and randomised lines in last season. Numerous typical ears of each of the four types have been selected from which to grow lines (ear-to-row) in the next season for examination as to any crossing or segregation of characters, when possibly useful information may be obtained.

Cultivation.

Simple cultivation experiments were carried out in Krian District on first class cropping land (Titi Serong) and on a third class area near Semanggol in single half-acre plots, to test the effects of tilling the soil as distinct from the usual method ("tajak"† only) of preparation of land for padi planting in this District, and the results are shown in the following table.

Table III.

Cultivation Experiment.

Area	Treatment	Strain used	Average Yield per acre in gantangs.	No. of 1/40 acre plots.	Increase.	Tillers per plant.
T. Serong (1st class land)	Nil.	Seraup 36	338 ± 16	3	—	12.7
	Changkolled*	„ 36	323 ± 64	3	Nil	11.0
	Straw removed	„ 36	327 ± 14	3	Nil	11.4
	ditto + changkolling	„ 36	306 ± 11	3	Nil	11.3
Semanggol (3rd class)	Nil	Radin 2	249 ± 10	10	—	10.0
	Changkolled	„ 2	314 ± 5	10	26%	11.3

* Jagoe, R. B. *Malayan Agricultural Journal*, Vol. XIX, No. 11, p. 530.

† Cutting down of the weeds at ground level with a special implement.

* To Chankol = to cultivate the land with a hand implement of the nature of a large draw-hoe.

In each area, all the plots were within the one field. The Titi Serong area suffered from excessively deep water during the growing period with a corresponding decrease in tillering. The plots show no material differences resulting from treatments. At Semanggol, cultivation gave a significant increase of 26 per cent. in excess of the control. This promising experiment will be continued.

Mechanical Cultivation.

A small experiment designed to give useful information regarding crops and costs of cultivation by mechanical means was carried out on an area of $3\frac{1}{2}$ acres divided into plots varying in size from $\frac{1}{4}$ to $1\frac{3}{4}$ acres, at Pulau Gadong Experiment Station. The implements used were a Fordson tractor, an Oliver 2-share plough, and John Deere two gang 14 disc harrow. The land was dry-ploughed to a depth of four inches and disc-harrowed to produce a fine tilth. Seed was broadcasted and drill-sown in different plots. The broadcasted seed suffered so severely from the depredations of birds that the yields were very small and valueless as a test, while the drill-sown padi also suffered severely in this respect, water control not being sufficiently good to maintain an adequate depth for the protection of the seed. The drill-sown padi produced an average of 175 gantangs of cleaned padi per acre which, under the adverse conditions experienced, could be considered quite a fair crop.

The experiment was valuable in showing that 0.8 of an acre could be ploughed and 2.3 acres could be harrowed within the hour, although on larger plots it is likely that these rates could be accelerated somewhat. Further, the experiment demonstrated the necessity for reliable control of irrigation and drainage and indicated that, under favourable conditions, padi cultivation by mechanical means should be possible at a cost of from $21—$25 per acre.

Double Cropping of Padi Land.

An attempt to grow two crops of padi per annum is being made at the Glugor Padi Test Station, and during the last ordinary padi season duplicate 1/40 acre plots were planted with early ripening types of padi with the following results.

Table IV.

Yields of Padi of Short Maturation Period

Variety		Average yield per acre in gantangs.	Average yield per acre in lbs.	Local Padi	Remarks
Radin Siak		140	765	248 gantangs	Planted late
Nachin	10	284	1630	- do -	Fair
Serendah	824	162	880	- do -	Thin and uneven
„	756	260	1300	- do -	Fair
„	724	120	700	- do -	Planted too late
Radin	2	destroyed	by floods	- do -	

All the plots in which the above varieties were grown were severely damaged by deep water during three small floods, and stem-borer infection was also fairly destructive. Despite unfavourable conditions which naturally prolonged the growing period, the Nachin 10 and Serendah 756 produced quite good crops slightly above the average for the locality. After harvest each of the above type was immediately resown for planting in the "off" season, but the soil was not cultivated, the old plants merely being removed by the "tajak" to save time. Growth of all varieties for the first month after planting was quite good, but subsequently a series of five short floods was experienced and the padi was much damaged, and in June, only three—Serendah 756, Nachin 10 and Radin Siak—shewed promise of producing satisfactory crops, but further rushing floods have now (September) ruined those. While there is no doubt that a second crop of padi can be grown within the year, the padi at this Station has not had a fair chance this season on account of the lack of drainage control. Rainfall water runs off from the hills so very quickly that each heavy shower causes a small flood in the padi fields, but arrangements are being made for the provision of better outlets for excess water before next season.

The success of double cropping will depend entirely on co-operation amongst local cultivators, since there can be no returns from planting small isolated areas which are bound to suffer considerably from rats, birds and other pests.

Seed Distribution.

For last season, the distribution for cash of selected seed from Titi Serong Station on a large scale was organised by the District Officer, Krian, in the Semanggol Mukim where pedigree strain Radin 2 had been shown to be the most remunerative padi. 5,400 gantangs of this strains were sold to cultivators and much better crops than those from local unselected seed were obtained and gave general satisfaction.

For the coming season, it is anticipated that a further 2,000 gantangs of seed of the same strain (R. 2) will be distributed in the same and adjoining "Mukims". In addition, Titi Serong Station supplies selected seed of several strains to numerous Test Stations and to cultivators on application. A fair quantity of seed is distributed in this way annually, while the crops obtained at individual Test Stations are also largely used for purposes of distribution.

It has been reported that in the neighbourhood of many Test Stations, cultivators who planted selected seed are desirous of continuing to plant the same strains. This gives some conception of the local opinion of selected seed, although it is difficult to estimate the amount in use or the areas planted with selected strains.

Pests.

The chief pests of padi during the last season were rats and stem-borers. Field Officers in most padi areas instigated rat destruction measures with undoubted beneficial results as can be gauged by the large numbers of rats destroyed during last year—in Krian 1,791,790 rats, in Province Wellesley 1,514,928 rats, in Malacca 75,817 rats—while trapping and the distribution of specially prepared poison-balls were effective in many other areas.

The Entomological Division continued researches into biological methods (distribution of parasites) of combating stem-borers which have been very destructive during the past three seasons. An experiment was laid down in Krian to trace the effect of borers on late planted padi. In this experiment, 12 duplicated 1/16 acre plots were used and plots 1—7 (duplicated) were planted at intervals of one week with seedlings from the one sowing of padi Radin 2. Plots 9—12 (duplicated) were planted at intervals of two weeks, but the seedlings at each planting date were derived from successive nurseries, so that the young plants at the time of planting these plots were all of the same age (optimum) for planting.

Table V.

Planting Methods and Stem-Borer Infection.

Plots	Average percentage borer infection on				Average yield of padi per acre in gantangs
	4/2/31	24/2/31	5/3/31	14/3/31	
1 + 1	10	26	32	45	450
2 + 2	15	30	35	50	400
3 + 3	18	19	33	46	440
4 + 4	—	23	31		200
5 + 5	—	19	52		No crop
9 + 9	—	27	53		460
10 + 10	—	20	42	37	400
11 + 11	—	35	26	40	270
12 + 12	—	28	25	20	No crop

Yields were calculated on two plots of 1/40 acre each in each plot. The very old seedlings used in plots 5, 6, 7 and 8 produced very few flowers and set no grain. Similarly, the late planted but normal aged seedlings in plot 12 gave no crop. The table indicates that late planted padi suffers somewhat less from borer attack but at the same time produces less crop than earlier planted padi, and that late planted padi from good seedlings produced poor crops although apparently less virulently damaged by borers, but the whole season was so abnormally late that little reliance should be placed on the results.

Meteorology.

At Titi Serong Experiment Station, rainfall and evaporation records have been maintained since 1927. The records for the past 3 years are summarised below.

Table VI.

Rainfall and Evaporation Records at Titi Serong.

		1928		1929		1930	
	Average Rainfall 41 years (inches)	Rainfall (inches).	Evaporation (inches).	Rainfall (inches).	Evaporation (inches).	Rainfall (inches).	Evaporation (inches).
January ...	5.35	5.92	4.612	1.22	4.820	3.03	5.106
February ...	4.22	2.52	4.740	9.86	3.560	2.91	5.127
March ...	7.56	5.03	4.946	8.52	4.752	6.65	5.810
April ...	8.41	10.97	4.218	3.81	4.458	3.93	4.538
May ...	7.01	7.08	4.716	5.71	4.918	3.18	5.328
June ...	5.11	6.69	4.494	6.41	4.718	3.11	4.934
July ...	5.29	4.18	3.878	0.40	4.684	2.58	4.824
August ...	7.05	2.91	4.422	1.65	3.962	4.91	5.402
September ...	9.50	12.25	3.430	12.27	6.426	7.18	5.796
October ...	11.73	8.51	5.282	8.98	4.300	15.14	5.138
November ...	10.62	13.12	4.324	12.92	4.270	10.36	4.474
December ...	6.94	8.47	4.076	4.73	5.768	6.64	4.290
Totals ...	88.79	87.65	53.138	76.48	56.636	69.62	60.767
Averages ...	7.40	7.34	4.428	6.37	4.720	5.80	5.064

The years 1929 and 1930 were exceptionally dry, particularly the latter, in which evaporation was apparently stimulated by the excessive dryness, and rainfall only exceeded evaporation by 9 inches.

During 1930 additional apparatus was obtained through the Meteorological Branch of the Survey Department, and records now include humidity, temperature, wind velocities and directions, and sunshine. Similar records which will be maintained at the Pulau Gadong Experiment Station should prove useful in course of time.

Summary.

1. It has been shown that several useful high yielding strains of padi, suited to varying conditions, have been isolated and tested against local popular but unselected types.

2. In many areas, selected strains have given more remunerative yields than the best local unselected types and in some areas, selected types are already planted over considerable areas.
3. There has been an advance in the number and in the organisation of Test Stations, though there is still need for expansion and improvement, particularly in relation to water control.
4. The best early maturing strains are Serendah 756, Nachin 27, Serendah 875 and Serendah 824.
5. The best strains of medium maturation period are Radin 2, Radin 13, Radin 4, Siam 29 and Nachin 10. This is the most important group in Malaya.
6. For areas which require a late maturing type of padi, the best strains are Seraup 36, Seraup 48, Seraup 15 and Seraup 1.
7. The search for better strains is being maintained and efforts are in progress to combine high yield and good eating qualities by the production of new races by hybridization.
8. Experiments in cultivation, pest control, and double cropping are in progress, and records of rainfall and evaporation in rice-fields have been tabulated.

Part II. MANURING.*

Experiments conducted previous to 1930 gave indications of increases of padi yield as a result of the application of phosphatic fertilisers. Ammonium phosphate gave the best results, while superphosphate, basic slag and Perlis (Malayan) phosphate were approximately equal. The increases were rarely large enough to be of practical importance and, although the experiments were continued for 6 years, statistically reliable evidence could not be obtained owing to insufficient replication resulting in large experimental error. In 1930 it was decided to abandon these experiments and to start a fresh series on more modern lines to be carried out at the Departmental Experimental Stations at Titi Serong in Krian, Talang at Kuala Kangsar and Pulau Gadong in Malacca. All three stations are irrigated, the first from the Krian canal system, the other two from rivers. Analytical characteristics of soils at the stations are given in Table I. Details of water conditions and pests during the season are to be found in the preceding section.

There were eleven treatments which, like the control, were replicated 6 times, arranged in 6 half-blocks grouped into 3 blocks. The area reaped for measurement was in each plot 1/40th acre†, guard rows of the appropriate

* Compiled from Departmental records by W. N. C. Belgrave, Plant Physiologist.

† Except at Talang, where by accident on a few plots only 1/80 acre was manured.

extent being provided to allow for bund effect. At Talang and Pulau Gadong the bunds were made of soil, were impervious and had little effect on growth; at Titi Serong they were composed largely of organic débris and were highly pervious. At the two former stations, bunds were constructed around each plot, while at Titi Serong, reliance was placed on the known high fixing power of local soils for ammonium salts and phosphates to prevent diffusion.

Following indications of previous experiments, attention was chiefly directed to phosphatic manuring. In order to test possible specific effects of ammonium phosphates, four of the treatment were sub-divided into application (a) of the synthetic manure and (b) of an ammonium sulphate-superphosphate mixture. All manures were lightly turned in and in addition at Titi Serong were mixed some weeks beforehand with damp soil in order to avoid loss and diffusion on application to the previously flooded fields. Details of treatments are given in Table II.

Two different kinds of padi were employed at each station, in order to test possible differential responses to manuring. At Pulau Gadong the varieties Siam and Nachin, at the other two stations the strains Radin 2 and Radin 4, were employed. All seed was from lines of known purity. It was originally intended that the distribution of the two kinds should be randomised, but difficulties connected with varying periods of maturation prevented this arrangement being carried out except at Talang; elsewhere distribution was by half-blocks. In consequence, some of the statistical advantage of the lay-out was lost as variation between half-blocks could not be separated from that due to differential response.

Dates on which operations were commenced were as follows:—

	Application of manures.	*Planting of nursery.*	*Transplanting.*	*Harvesting.*
Titi Serong	22.11.30	15.10.30	28.11.30	30.3.1931
Talang	2.10.30	28. 8.30	9.10.30	27.2.1931
Pulau Gadong	6. 7.30	7. 6.30	24. 7.30	19.1.1931

At Titi Serong weeds were cut close to the ground, allowed to rot for a fortnight, raked up and piled on the bunds as is the usual custom in Krian.

At Talang the land was turned over by hand cultivation to a depth of 6 inches, weeds being turned under in the process.

At Pulau Gadong the land was ploughed with a Malay plough.

Table II summarises results obtained, the two kinds of padi (and of manure in treatment I—IV) being taken together. For the sake of clarity, results are presented as pounds and gantangs per acre of cleaned dried padi; they were actually recorded in katies and gantangs at Titi Serong, gantangs at Talang and pounds and gantangs at Pulau Gandong. (1 kati = 1.33 lbs; 1 gantang = 1 imperial gallon.)

Statistical working has been carried out on weight figures except at Talang.

For conversion where necessary in Tables II and III the following factors have been used.

Titi Serong	1 gantang	= 5.52 lbs.
Talang	1 ,,	= 5.74 ,,
Pulau Gadong	1 ,,	= 5.45 ,,

The Titi Serong and Pulau Gadong factors are derived from the manurial plots, that for Talang from adjacent plots.

There was little variation between races—Radin IV and Nachin being slightly the heavier, as shown in Table III.

The justification for the combining of different kinds of padi and of manures (in treatment I—IV) is to be found in Tables III and IV where differences are seen to be small.

The discrepancies in Table II between weights and measures illustrate the difficulty of accurate volume measurement of small quantities of padi.

Deductions.

The large increases recorded at Talang lose much practical importance when it is realised that the controls were far below normal for that station, possibly as a result of the land on which these trials were carried out having received poor tillage for a number of years.

On Pulau Gadong one treatment only (No. 5) shows significant increase and, at Titi Serong, increases, where they occurred, failed to reach the not unduly high standard of significance.

Since the control plots on the manurial areas did not give yields greater than the average of the Station it may be accepted that the lack of response is real and not due to raising of yields on the control by diffusion.

These disappointing results, added to those of former years, furnish strong evidence that manuring of wet padi on orthodox lines has a limited future on average land in Malaya. It is noteworthy that everywhere vegetative growth on the manured blocks was at the beginning markedly superior to the controls and that the differences were gradually lost at Pulau Gadong and Titi Serong, but persisted at Talang.

When considering the financial side it must be remembered that the more expensive treatments were definitely experimental. The fact that Perlis Phosphate alone gave good results at Talang suggests that nitrogen may ultimately be found to be unnecessary. If this proves correct, costs would be reduced by more than half, and comparatively small increases of crop, if certain of attainment, would justify the application of fertilisers.

The Talang results suggest that application of a cheap fertiliser might be useful on poor or neglected land to increase a first crop which would otherwise be small. This confirms the opinion expressed by the British Adviser, Perlis, as to the relative response to be obtained from good and poor land.*

*Report of Rice Cultivation Committee, F.M.S., 1931, Vol. II, page 122.

The large experimental error found in these experiments taken in conjunction with the equally large error shown by the varietal and other tests (Table I, page 578 supra) is surprising and unwelcome, and is being further investigated.

Experiments in the Coming Season.

Since the utility of orthodox forms of manuring appears to be limited it has been decided to broaden the basis of experiment. The new treatments will be :—

Nursery manuring with ammophos;

Nursery manuring with ammophos followed by field manuring with superphosphate;

"Chelluping" with bone meal;

Field manuring with a basic mixture;

Field manuring with a complete mixture containing nitrogen, phosphate, potash, calcium and magnesium.

"Chelluping" i.e. the old practice in Malacca of dipping padi plants at transplanting into a paste of bone meal or ground bones, has given indications of usefulness at Pulau Gadong. The basic mixture is designed to test the somewhat remote possibility that our acid soils may respond better to such a mixture than to neutral or acid fertilisers. The complete mixture is intended to test the equally remote possibility that there are several deficient elements, each of which must be added before response is obtained.

As the new experiments are to be carried out on the ground used last year, new treatments will be arranged to run "across" old ones in order to avoid possible residual effects, of which there were some indications at Pulau Gadong last season on land used for the older manurial experiments. Last season's treatments (Nos. IV, VI and X) will be repeated, and the land occupied by No. IX and XI will be used accurately to test residual effects.

At the new station at Bukit Merah in Province Wellesley a simpler experiment has been designed to test—

(a) Nursery manuring with ammophos.

(b) Field manuring with ammophos.

(c) "Chelluping" with bone meal.

Table I.

Analyses of bulked samples of soil.*

(a) Mechanical.

Station.	Clay per cent	Silt per cent	Fine sand per cent	Coarse sand per cent	Gravel per cent	Loss on ignition
Titi Serong	51	35	10	Nil	Nil	12
Talang	44	24	18	9	2	12
Pulau Gadong	33	37	29	Trace	Nil	7

*Topsoil; sub-soils (i.e. second nine inches) showed no appreciable variation.

(b) Chemical.

Station.	K_2O per cent	P_2O_5 per cent	CaO per cent	Fe_2O_3 Al_2O_3 per cent	Fe_2O_3 per cent	MgO. per cent	N. per cent	C. per cent	pH suspension	pH filtrate.
Talang	1.09	.08	.22	23.3	4.19	.41	.22	2.4	5.2	6.6
Titi Serong	.53	.06	.03	26.2	3.47	.01	.19	1.6	5.4	6.8
Pulau Gadong	.62	.03	.04	12.2	1.77	.45	.14	2.6	4.2	5.8

Table III.

Yield per acre from different varieties or strains.
Means of all treatments.

Station	Variety, Radin II.			Variety, Radin IV.		
	lbs.		Gant.	lbs.		Gant.
Titi Serong	2,032	(5.49 lbs. = 1 Gant.)	370	1,998	(5.57 lbs. = 1 Gant.)	357
Talang	2,196	(5.72 lbs. = 1 Gant.)	384	2,258	(5.76 lbs. = 1 Gant.)	392
		Siam.			*Nachin.*	
Pulau Gadong	1,857	(5.42 lbs. = 1 Gant.)	343	1,921	(5.48 lbs. = 1 Gant.)	350

For reasons already given the significance of differences at Titi Serong and Pulau Gadong cannot be calculated; at Talang the minimum significant difference would be 131 lbs. or 25 gantangs per acre.

Table IV.

Average yield per acre from Ammophos and corresponding ammonium sulphate—superphosphate mixture.
Means of treatments I—IV.

	Ammophos.		Mixed manure.	
	lbs.	Gant.	lbs.	Gant.
Titi Serong ...	2,185	395	1,968	357
Talang ...	2,267	395	2,330	406
Pulau Gadong ...	1,866	342	1,777	326

TABLE II

Treatment.	FERTILISER	Quantity lbs. per acre	Nutrients supplied lbs. per acre [round numbers]: N.	P_2O_5	Cost per acre.	YIELD IN POUND: TITI SERONG Increase over Control.		TALANG Increases over Control.		PALAU GADONG Increase over Control.		YIELD GANTANGS: TITI SERONG	TALANG	PALAU GADONG
I	(a) Ammophos 20/20 ...	75	12	15	$3.94	2,234	319	2,080	656	1,960	160	390	361	357
	(b) Ammonium Sulphate ... 57 Superphosphate (single) 79		12	15	$4.26									
II	(a) Ammophas as in I (a) ...	150	25	30	$7.88	2,234	319	2,253	829	1,680	120	400	391	308
	(b) Ammonium Sulphate ... 114 Superphosphate ... 158		25	30	$8.52									
III	(a) Ammophos 24 of 20/20 76 of 13/48 ...	100	12	41	$6.01	1,968	53	2,225	801	1,960	160	360	386	352
	(b) Ammonia Sulphate ... 57 Superphosphate ... 217		12	41	$7.66									
IV	(a) Ammophos as in III (a)	200	24	82	$12.01	1,915	nil	2,801	1,377	1,720	80	350	486	315
	(b) Ammonium Sulphate ... 114 Superphosphate ... 435		24	82	$15.32									
V	Ammonium Sulphate ... 29 Superphosphate ... 193		6	37	$6.38	2,234	319	2,282	858	2,080	280	385	396	379
VI	Ammonium Sulphate ... 57 Superphosphate ... 385		12	73	$12.76	1,862	53	2,415	991	1,960	160	334	419	352
VII	Ammophos as in III (a)	100[3]	12	41	$7.98	2,181	266	2,305	881	1,960	160	390	400	362
	Potassium Sulphate ... 40 90% basis													
VIII	Ammophos as in III (a)	100[4]	12	41	$14.96[2]	1,968	53	2,300	876	2,000	200	350	399	371
	Magnesium Sulphate ... 117													
IX	Perlis Phosphate ...	200	—	46	$2.24	1,068	53	1,879	455	1,800	0	366	326	324
X	Perlis Phosphate ...	400		92	$4.48	1,869	106	2,352	928	2,040	240	330	408	373
XI	Perlis Phosphate ...	200												
	Ammonium Sulphate ...	57	12	46	$4.56									
XII	Control ...					1,968	53	2,340	922	1,880	80	340	407	340
						1,915	—	1,424		1,800	—	365	247	325
						Standard error of one pot.	404		388		260			
						Increase which would have significance P = 0.05	425		403		270			

1. Calculated from cost per ton or per bag ex godown, Kuala Lumpur or Port Swettenham, July 1931. Cost to small buyers would be higher.
2. Epsom salts purchased at drug rates.
3. Supplying 19 lbs. K_2O per acre.
4. Supplying 19 lbs. M_gO per acre.

THE PREPARATION OF ORGANIC MANURE.

A Preliminary Investigation

BY

R. G. H. WILSHAW,

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Division of Soils and Plant Physiology.

The utilisation of waste vegetable products for the preparation of an organic manure is a problem which is engaging attention in the tropics at this time.

It has been found in other countries (1) that the incorporation of cattle manure with relatively large quantities of fresh organic waste such as grass cuttings, padi straw and other like material, results in an increased rate of decomposition.

This is of special interest to Malaya in that the recent introduction of stock by the Department of Agriculture to the Experimental Plantation at Serdang and to Fraser's Hill, foreshadows further development of cattle raising throughout the country and a consequent increasing quantity of available cattle manure.

The addition of cattle manure to a heap of freshly cut organic waste is equivalent to innoculating with a population of various micro-organisms capable of decomposing the organic material present. In the case of grass cuttings or any other freshly cut green material the water soluble constituents of both the cattle manure and the cuttings act as an immediate supply of food and energy for a rapidly increasingly micro-organic population; given the latter, the rate of decomposition and practical value of the resultant material is intricately bound up with the content, assimilation, conservation and loss of nitrogen and the chemical constitution of the original materials.

Pending large scale investigations which this Department contemplates carrying out at Serdang on the production of organic manure from vegetable waste and farmyard material, small scale experiments were started in January 1931.

The main object of these was the determination of the time-factor, the period over which the main experiments would have to be extended, and the frequency of sampling required.

In these experiments the reduction in 'pentosan' content of the organic material was taken as an index of decomposition, "pentosans" being determined by the method of Kröber (2)

This index has been used previously by Greenstreet (3) on work of this nature.

Recent work by Waksman (4) and Norman(5), on the nature and difference in rate of decomposition of the hexose, pentose, and uronic acid complexes (often term hemi-celluloses) in plants, casts doubt upon the value of this index for accurate work. However, as a rough index it was deemed to suffice for the following experiments.

Experimental.

Towards the end of January 1931, six concrete pits approximately 6 feet square and 18 inches deep, having a sump in one corner loosely covered with boards, were filled with a mixture of fresh grass cuttings and cattle manure.

The cattle manure was obtained from local Bengali cowherds, and being adulterated with soil was of very inferior quality. The loss on ignition of this material (on dry basis) was only 10 per cent.

Table I.

Weight of materials in each pit on fresh and dry basis.

Pits	Fresh Weight in Lbs.		Dry Weight in Lbs.		Proportion
	Grass Cuttings	Cattle Manure	Grass Cuttings	Cattle Manure	
1 & 2	225	375	68	122	1 : 2
3 & 4	150	450	49	146	1 : 3
5 & 6	300	300	98	97	1 : 1

In the odd numbered pits the mixture was arranged in three layers of each of cattle manure and grass cuttings; in the even numbered pits the whole contents were well mixed together.

The proportion of cattle manure to grass used in Pits 1 and 2 are approximately those used on Government Plantations in this country.

Pits 1—4 were under a glass roof, Pits 5 and 6 were exposed. All Pits were kept thoroughly wet (80—90 per cent. moisture) for the first two months. At the end of this period water was cut off and the material allowed to dry. Pits 1—4 thus became permanently dry, Pits 5 and 6 being dependent on weather conditions. As far as was practicable the sumps in every pit were periodically emptied.

The table below gives the "pentosan" content of the grass cuttings after various intervals under the above conditions. In sampling, care was taken ro exclude any lumps of cattle manure or soil, and to confine the material as far as possible rigidly to the grass cuttings.

Table. II

Percentage "Pentosans" in grass cuttings (on dry basis).

Pit.	27.1.31	4.2.31	12.3.31	12.6.31
1	35.0	19.65	—	3.0
2	35.0	21.0	2.9	3.7
3	35.0	23.95	8.3	5.6
4	35.0	24.9	3.1	3.4
5	35.0	18.55	14.3	5.1
6	35.0	16.25	14.7	5.8

Conclusions.

Rapid decomposition of grass cuttings treated with cattle manure as judged by loss of "pentosans" occurs during the first week under 70—80 per cent. moisture conditions and at a mean temperature of 82°F., and, avoiding excess of water, this action is practically complete within seven weeks.

Literature Cited.

(1) Fowler, G. J. Agricl. Journal India Vol. XXV part V Sept. 1930.
(2) Kröber, E. Jour. Landw. 1900.48.357.
(3) Greenstreet, V. R. M.A.J. Vol. XVI No. 5 May 1928.
(4) Waksman, S. A. Soil Sci. Vol. XXXII, No. 2 August, 1931.
(5) Norman, A. G. Biochemical Jour. 1929, Vol. XXIII p 1353.

Reviews.

The Export Crops of the Netherland East Indies in 1930.*

Bulletin No. 97 of the Central Bureau of Statistics.

Department of Agriculture, Industry & Commerce, Buitenzorg,

September, 1931, pp. 253. Price 6 shillings.

The report defines the difference between local "estate agriculture" and local "native agriculture", gives general remarks on agricultural statistics followed by comparative statistics, since 1894 of the yearly total values of estate and native produce exported and particulars showing the economic importance of the Dutch East Indies as an exporter of tropical produce for the world's markets.

Value of Total Exports.

The statistical tables given shew the tremendous decline in the values of the exports of 1930, as compared with the preceding years, in consequence of the world-wide decline of market prices for agricultural produce. As before, the values of rubber and sugar exports combined constitute about half of the total value of agricultural exports. The figures (in Grs. 1,000) were:—

	Rubber	*Sugar*	*Combined*	*Total*
for 1929 ...	233,429	311,592	545,021	1,082,757
for 1930 ...	168,932	254,275	423,207	859,567

Proportionately this works out at:

21.56 per cent. 28.78 per cent. 50.34 per cent.
19.66 per cent. 29.59 per cent. 49.25 per cent.

Though the exports of sugar decreased from 2,946,440 metric tons in 1929 to 2,807,600 metric tons in 1930, it has fully maintained and even slightly improved its relative position. Rubber exports fell from 261,494 metric tons in 1929 to 243,258 metric tons in 1930. The difference is almost exclusively due to a decrease of 18,088 metric tons of native produce. The disastrous fall of rubber prices—especially for native produce, as will be shown later on—is responsible for the deterioration of its relative economic importance.

The value of the total exports of agricultural products from estates and native agriculture in millions of guilders was 1929, 1,083; 1930, 859.

As was to be expected, the total value of the 1930 exports has been far below the 1929 figure. Since 1925 this total value has been steadily falling

*A review of the 1929 Report (Bulletin No. 86) was published in the *Malayan Agricultural Journal*, Vol. XVIII, No. 12.

except in 1927 when there was a partial recovery. On the other hand, the volume exported has not decreased; the decrease of Grs. 224 millions is wholly due to the world-wide depression and the appreciation of gold. Relatively largest is the decrease of the value of native produce from the Outer Possessions from Grs. 291 to 189 millions. For 1925 the figure was Grs. 429 millions and it has been steadily falling ever since. This too was to be expected, because the bulk of the exports of native produce from the Outer Possessions has for the last 8 to 10 years been rubber, whereas there is no native rubber production in Java. Yet there, too, the decrease of the value of native produce exported has been relatively large. Compared with 1929 the decreases of the values of all classes of the 1930 exports (expressed in percentages of 1929 values) have been :—

Java		Outer Possessions		Netherland East Indies	
Estates	Native	Estates	Native.	Estates	Native
16.53	32 7	3.92	35 05	12.79	34.43

It should, however, be borne in mind that the figures, given above, represent values of exported produce only and that native agriculture in addition thereto supplies practically all food required by a population of about 61 millions.

N.E.I. Share of World Production.

As a producer of export crops for the world market requirements, the Dutch East Indies have, on the whole, fairly well retained their position, as will be seen from the following table which shows the principal Dutch East Indies exports in percentages of world exports.

		1927	1928	1929
Rubber	...	38	35	30
Sugar	...	10	11	10
Coffee	...	6	8	6
Tea	...	16	17	17
Cinchona	...	91	93	94
Copra, Oil etc.	...	23	30	30
Palm Oil & Kernels	...	3	5	5
Fibre (Sisal etc.)	...	19	19	22
Kapok	...	76	79	75
Pepper	...	53	70	69

For these and other export crops detailed figures are given in this publication firstly in a table specifying the volumes and values of their contributions, secondly, in special reviews dealing with each crop. The statements concerning

some of the most important crops are given below after conversion of planted areas into acres and of weights into tons of 2,240 pounds.

Rubber.

		Area in acres.		*Crop exported.*
Hevea.	Estates.	Planted	1,415,918	
	,,	in bearing	912,417	151,113 tons
	Native	?		89,070 ,,
Ficus				27 ,,
		Total production exported		240,210 ,,

The report states that the production of British Malaya and of the Netherland East Indies during the last five years, expressed in percentages of world production, have been as follows:

	1926	1927	1928	1929	1930
British Malaya ...	46.79	39.73	45.30	51.93	53.92
Netherlands East Indies ...	31.65	37.60	34.83	29.88	29.04

Estate area, both that planted and the area in bearing, shows small increases only over the 1929 area; respectively 4.65 and 2.43 per cent. Estate production has been very slightly (0.4 per cent.) below 1929 estate production, due to partial cessation of tapping on some estates.

Native production decreased greatly in comparison with 1929 by 16.66 per cent. No estimate of potential production, present or future, is given.

Cane Sugar.

	Area in acres.	*Production in tons.*
Estates	489,275	
Native	33,541	
	522,816	2,869,947

Part of the native produced cane is sold to the factories; the remainder is converted into sugar for native consumption locally (Java) and in other parts of the Netherlands East Indies. The figure for total sugar production refers to factory produce only and includes part of native cane crop, bought by the factories.

The report further mentions an export of 17,480 tons of native made cane sugar, but this probably only means export from Java to the other islands for native consumption.

Coffee.

		Area in acres.	*Export.*
Estates	planted	322,063	
	in bearing	248,407	39,678 tons
Native	?		53,382 „
		Total export	93,060 tons

The estate planted acreage includes areas with mixed crops.

The total export figures shewn above for native production include exports of native coffee from some of the Outer Possessions to Java and other islands for local native consumption. This, combined with storage in times of low market prices, reduces the figure for the nett export to 60,545 tons. In the review of the Report on the 1929 exports a figure of 80,526 tons should, for the same reason, have been given for nett export.

The coffee-bearing area consists of :—

		Area in acres. *Planted.*	*In bearing.*	*Production in tons.*	
Robusta	Estates	299,416	231,602	37,775	
	Native	?	?	46,517	84,292
Liberia	Estates	5,879	4,566	293	
	Native	?	?	39	332
Arabica	Estates	13,052	9,859	1,269	
	Native	?	?	6,791	8,060
Other	Estates	7,710	5,192	341	8,060
	Native	?	?	3	344
				Total	93,028 tons

Tea.

		Area in acres.	*Production.*
Estates	planted	313,807	
	in bearing	257,122	56,720 tons
Native in bearing		79,245	14,137 „
		Total	70,857 tons

Production figures above include tea made from leaf bought from native growers.

The planted estate area has fairly steadily increased from 255,457 acres in 1926 to 313,807 acres in 1930 and the estate area in bearing from 221,673 acres in 1926 to 257,112 acres in 1930.

The planted native area simultaneously increased from 70,740 acres to 101,262 acres and the native area in bearing from 58,427 to 79,245 acres.

Tobacco.

		Area in acres.	*Leaf.*	*Krossok.*
Estates	Java	80,285	22,511	18,234 tons
	Sumatra	49,934	18,876	
Native	Java	369,701		24,068 ,,
	Other	?		483 ,,

Estate production in Java includes produce made from leaf bought from native growers. "Krossok" is the low grade tobacco that is cut up for pipe-tobacco and used for cigar-fillings.

Quantities of native produced Krossok tobacco shewn above represent exports to foreign countries only. In addition thereto there is an inter-island trade of about 1,223 tons of native produce. No figures are given for local consumption or for total production.

Cinchona.

		Area in acres.	*Production in tons of dry bark.*
Estates	Planted	47,171	
	in bearing	38,469	11,691 tons

Coconuts.

		Area in acres.	*Copra and copra equivalent of oil.*
Estates	Planted	127,583	
	in bearing	70,698	27,301 tons
Native		?	366,411 ,,
		Total export	393,712 tons

The total crop from estates shewn above includes 2,296 tons, made from nuts bought from native growers. The total export figure does not include the local native consumption which for 1930 was estimated to have been 390,750

tons for Java alone and in proportion to population may have been about 178,000 tons for the Outer Possessions.

The 1930 total export was 107,701 tons below the 1929 figure, partly owing to the drought and partly owing to the market prices which decreased copra production for export and increased local consumption. For Java alone the decrease has been 85,260 tons; Java during 1930 had practically ceased to be a copra exporter. Recovery, even in years of more favourable seasonal and market conditions, in the reviewer's opinion, is not likely to be more than partial, owing to the food requirements of the steadily increasing population and the scarcity of suitable land for new large scale planting. Estate production contributing only 7 per cent. to the total export; native production in the Outer Possessions (chiefly Celebes, Borneo, Sumatra & Riouw) already entirely dominates the situation.

Oil Palm.

	Area in acres.			*Production.*	*Export.*
Estates.	*planted.*	*in bearing*			
Java	1,747	356			
Outer Possessions	149,550	73,997	Oil	48,978	47,258 tons
Total	151,297	74,353	Kernels	9,666	9,488 ,,

Production is likely to increase rapidly owing to the large area not yet in bearing.

Fibres.

The export of fibres amounted to 64,633 tons, of which 16,148 tons was estate produce and 48,485 produced by natives.

Area figures, being admittedly incomplete, have not been stated.

Tapioca.

Export in Tons

Crude dry tubers	Ground dry tubers	Flour	Flake	Pearl	Ampas
10,849	28,699	73,875	4,744	10,708	4,544

No reliable figures of the estate area can be given.

The area of native cultivation in Java is given at 1,606,150 acres, producing 5,133,858 tons of fresh tubers. Comparison of these figures for the last five years gives the following average yields per acre of fresh tubers :—

	Area in acres.	*Yield in tons.*	*Average.*
1926	1,680,280	5,411,417	3.22
1927	2,038,575	6,790,353	3.33
1928	1,826,069	6,063,977	3.22
1929	1,754,410	5,048,228	2.88
1930	1,606,150	5,133,858	3.20

The decrease of the native area in cultivation in 1930 was largely due to the drought during 1929, hampering planting. The relatively better yield produced a crop slightly exceeding the one of 1929. Native consumption increased to such an extent that the quantity available for export was greatly reduced. For the 4 years 1927-1930 the exports were :—

	1927	1928	1929	1930
Crude dry tubers ...	22,330	55,068	20,065	10,849
Ground dry tubers ...	94,498	270,224	98,075	28,699
Flour ...	102,941	124,922	114,918	73,875
Flake ...	4,926	10,176	6,824	4,744
Pearl ...	13,054	26,264	18,755	10,708

Even though it is probable that the native area, productive during 1931, will again be larger than in 1930, owing to more favourable conditions in the planting season, the figures seem to indicate that Java is declining fast in importance as a tapioca flour exporter and it may be well worth considering to what extent Malaya would be able to replace it as a supplier of the world market.

The figures given above relate to Java only. There is apparently no export of tapioca from the Outer Possessions.

Kapok.

	Area in acres		*Kapok*	*Seeds*	*Oil*	*Seedcake*
	planted	*in bearing*				
Estates	43,648	18,320	1656	3069	—	—
Native	?	?	19075	6164	2672	9173
		Total exports	20731	9233	2672	9173 tons

Practically the whole quantity exported comes from Java and this crop is predominantly native.

Other Products.

Cocoa.—The total area planted on estates is 22,944 acres of which 9,704 acres are in bearing and produced 1,185 tons of cocoa; native production accounting for a further 255 tons of cocoa.

Interest in this crop seems to be reviving and possibly it will remain predominantly an estate crop.

Pepper.—The estate area under this crop is stated to be 4,245 acres, of which 2,861 acres are in bearing. The total export was 31,889 tons, of which but 243 tons was from estates.

Gambier.—No gambier is grown in Java; cultivation (estate as well as native) is confined to Sumatra, Borneo, Rhio and Banka. The planted area on estates is 4,796 acres of which 4,136 acres are in bearing and exported 4,400 tons. The native area is unknown, but the exports from this source amounted to 8,939 tons, making a total export of 13,339 tons.

Arecanuts.—This is exclusively a native crop. The total exports were 41,926 tons, 7,461 tons of which were from Java and 34,465 tons from the Outer Possessions. North and North East Sumatra was responsible for 85 per cent. of the exports from the Outer Possessions.

Among other foodcrops grown chiefly for local consumption, rice, maize and groundnuts are most prominent. For Java the following production figures can be given : :

Rice.—(wet padi and hill padi together) 8,794,290 acres. Of this area 87 per cent. was irrigated and 13 per cent. dry land. The total production was 3,588,103 tons of rice in the husk, 93 per cent. of which came from the irrigated land whilst 7 per cent. came from the dry land.

The 1930 report for the first time gives production figures in weights of "rice in the husk" instead of "rice in the ear" as before. The former weight is about 54½ per cent. of the latter.

In 1930 Java exported 30,139 tons of husked rice to the Outer Possessions (chiefly Banka and Borneo) and imported from there (chiefly Bali and Lombok) 5,100 tons. In addition thereto Java imports husked rice from Burma and Siam. These latter imports fell from 329,603 tons in 1929 to 228,051 tons in 1930 in spite of its normal yearly increase of population by about 750,000.

For the Outer Possessions no reliable production figures can be given; only those for imports and exports. Only the islands Celebes, Bali and Lobok show an import surplus. The final nett import surplus for the whole of the Outer Possessions remained stationary; it was 396,060 tons of husked rice in 1929 and 396,059 tons in 1930. For the chief native rubber producing countries (Rhio, Jambi, Palembang and Borneo) the import surplus was :—

1928.	1929.	1930
146,588	115,991	106,106 tons
35.8%	29.4%	26.5% of the

total quantity imported in the Outer Possessions. Taking into account the normal increase of populations, these countries appear to have increased their local food production.

The East Coast of Sumatra—the centre of the large scale capitalist rubber, tobacco and oil palm cultivation, employing practically exclusively imported labour—imported 187,322 tons = 47.3 per cent. of the total. Banka and Billiton with their large population of mining coolies imported 50,750 tons = 12.8 per cent. of the total.

Maize.	*Area in acres.*	*Production.*	*Export.*
Java	4,944,470	1,974,705	77,561
Outer Possessions	?	?	39,165
Total export to foreign countries			116,726 tons

This is an exclusively native-grown crop.

Groundnuts.	*Area in acres.*	*Production.*	*Export.*
Java	553,504	163,193	18,237 tons
Outer Possessions	?	?	1,247 ,,
Total export to foreign countries			19,484 ,,

All weights are given for "shelled nuts". This too is an exclusively native-grown crop.

Sago.—The export from the Outer Possessions to foreign countries has during the last 5 years has been as follows :—

1926	1927	1928	1929	1930
15,080	25,468	32,511	41,396	50,735 tons

It is interesting to find that the East Coast of Sumatra has supplied 90 per cent. of the total increase since 1926.

Furthermore, mention of export to foreign countries is made of :—Potatoes 6,221 tons, Chillies 1,644 tons, Onions 1,526 tons, Cotton 1,386 tons.

L. A. J. R.

Journal of the Rubber Research Institute of Malaya.

Vol. 3, No. 2, October 1931. Price 50 cents.

The latest issue of this Journal contains two articles of very general interest to rubber planters on the subject of the manuring of rubber. The first of these gives a résumé of the present position on manuring of rubber with illustrative cases based on Malayan data, written by Dr. W. B. Haines and

Dr. C. F. Flint. It is an attempt to collate and interpret the information which the Soils Division of the Institute has collected during the past three years. A brief history of typical instances of manuring on estates is given with the results so far observed in each case.

In a great number of cases the results of manuring have proved uncertain, a fact which renders it impossible at present to recommend a manuring programme on a large scale with the certainty of economic success.

The best results appear to be obtained by the manuring of trees of good growth and appearance, but with poor yield. The manuring of trees of poor growth is not expected to give such rapid response to manuring as judged by yield of rubber; it is pointed out that "since both foliage and bark must necessarily be in a healthy condition to make steady high latex production possible, and since bark is slower to response than leaf, it is obvious that delay is to be expected. Within limits, it may be said that the time taken to obtain yield response is proportional to the time during which the tree has been allowed to deteriorate".

The authors warn the rubber planter to exercise patience in the conduct of his manurial experiments and not to abandon experiments because results are not quickly forthcoming.

The second article concerning the manuring of rubber is by the same authors and is a record of measurements of the development of trees under a controlled system of manuring at the Rubber Research Institute Experiment Station. The last series of measurements was made when the trees were just over two and a half years' of age from the time of planting.

The differences recorded are not large enough to be of practical importance, but significant effects have been produced by cattle manure. "In addition, girth was improved where nitrogen alone was given and total growth was improved by a complete chemical fertiliser, but none of the other figures are significant".

In a further article on the effect of covers and clearing methods on the growth of young rubber, Dr. Haines records the growth measurements on blocks of young rubber planted seed at stake, basket planted and planted with timber left and on cleared land. Under each condition of planting, areas have been cleaned weeded and other areas planted with plots of calapogonium, crotalaria and Leucana.

It is pointed out that "too much importance must not be placed upon early difference of growth, which are easily observed, without weighing factors which may come into play later". The present position shows that there is retardation of growth on the plots in covers, the effect being greater where rubber stumps were used than where rubber seedings were planted. The seed-at-stake planting is still behind, but it is rapidly catching up the rubber planted by the other methods. Basket plants have maintained a slight superiority over stumps on the plots with covers, but on clean weeded plots there is little to choose between them.

Records are also given of the growth of rubber closely planted and in which secondary jungle is allowed to develop. The conditions are designed to approximate those obtaining in native holdings. Amongst the interesting observations recorded in this connection is low incidence of *Fomes lignosus* at the present stage. This confirms the statement published in the last number of the *Malayan Agricultural Journal* respecting the incidence of root disease on native rubber holdings.

Other articles in this number of the *Journal of the Rubber Research Institute of Malaya* are "A further note on the effects of fungicides on the viability of Hevea buds" by R. P. N. Napper, and "The identity of the fungus causing wet-root rot of rubber trees in Malaya" by E. J. H. Corner.

D H. G.

Miscellaneous Tropical and Sub-tropical Florida Fruits.

by H. Mowry and L. R. Toy. University of Florida Agricultural Experiment Station Bulletin 223; January 1931, 88 pp. *74 figs.*

The Malayan reader of this bulletin will recognise in the excellent illustrations many fruits familiar to this country and several that are not represented locally.

Florida includes both tropical and sub-tropical regions, in consequence of which the authors have indicated by means of numbers the comparative hardiness of the fruits described. This is of considerable importance to readers in Malaya as it enables one to judge the chances of success of importations of these fruits.

The bulletin gives brief notes on propagation and cultivation of fruit trees, followed by a concise description and method of cultivation of some forty varieties of fruit trees.

If this is a fairly complete list of the tropical and sub-tropical fruits of Florida, one is struck by the fact that Malaya, although possessing a uniform climate throughout the country, contains a very much longer list of fruits. This does not, however, minimise the value of the Florida publication towards the possibility of improving local fruits or adding to their number by importations of stock from Florida.

The publication is recommended to those in Malaya who are interested in fruit cultivation. It is stated that a copy of the Bulletin will be sent free upon application to the Agricultural Experiment Station, Gainesville, Florida.

D. H. G.

Plant Breeding Abstracts.

Imperial Bureau of Plant Genetics School of Agriculture, Cambridge, England. Published quarterly. 1s. 6d. per copy or 5s. per annum post free.

The Imperial Bureau of Plant Genetics has begun to issue a publication entitled "Plant Breeding Abstracts" in which all the more important current publications dealing with plant breeding and the genetics of crop plants are listed. The references are classified according to subject and each reference is followed by an abstract indicating the subject matter of the paper and the results obtained. The papers are divided into two halves, those published in the British Empire and those published in foreign countries. Papers written in foreign languages are usually abstracted somewhat more fully than papers in English.

"Plant Breeding Abstracts" Vol. 1 No. 3 published on April 1st, 1931, contains 197 references covering 52 pages.

Erratum.

With reference to the article entitled "Baled Copra" appearing in this Journal, Vol. XVIII, June 1930, page 281 et seq. it has been found that the figures on page 287 for the oil contents of 17 different bulk consignments of Straits F.M.S. copra as determined by consignees in Europe referred to the copra as received and not as stated to the product on a dry basis.

The amended figures for the table are therefore as follows:—

	Average per cent.	Maximum per cent.	Minimum per cent.
Moisture ...	4.7	5.5	3.9
Oil (wet basis) ...	65.0	67.0	63.6
Oil (dry basis) ...	68.2	70.0	66.2
Acidity (oleic acid) ...	2.19	5.36	0.35

Miscellaneous Article.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE HELD ON NOVEMBER 5th 1931.

A Meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 5th November, 1931, at which the following members were present :—

The Acting Director of Agriculture, Mr. F. W. South (*Chairman*); the Director of Co-operation, Mr. A. Cavendish; the Director, Rubber Research Institute, Lt. Col. B. J. Eaton, O.B.E.; the Principal, Sultan Idris Training College, Mr. O. T. Dussek; the Raja Muda of Perak, Mr. M. J. Kennaway, Mr. J. Melville, Mr. R. E. M. Michaux, Mr. G. S. Reis, Mr. W. A. Stanton and the Assistant to Director of Agriculture, Mr. W. N. C. Belgrave (Secretary).

At the meeting various subjects were discussed, these included :—

1. *Re-organisation Proposals for the Department.* The Secretary of State had accepted the proposals of the Government of the Straits Settlements and Federated Malay States for the re-organisation of the European Staff of the Department and the necessary changes would be effected at an early date.

The construction of new laboratories and offices for the Department had been postponed.

2. *Padi.* The distribution of tested pedigree seed by sale in Krian had not been a success, only 2,000 gantangs having been sold. This disappointing result was attributed to insufficient knowledge of the benefits to be derived from the planting of pedigree strains; in consequence the establishment of five Test Plots in Krian was envisaged and it was anticipated that three would be brought into being in 1932.

3. *Coconuts.* The report of the Assistant Chemist for Copra Research on his visit to Ceylon was ready and would in due course be published. The next step in the copra investigation was to be on the design and improvement of kilns.

Owing to the need for economy the proposed extension of the Coconut Experimental Station, Klang, had been postponed; an attempt was to be made to carry out eslewhere experiments on the manuring of young coconuts.

An attempt was to be made to obtain information on the effect of epiphytic growths on coconut and oil palms, as considerable sums were expended annually in removal of such growths.

4. *Oil Palms.* Fees for analysis of commercial products of the Oil Palm had been reduced.

5. *Serdang Experimental Plantation.* Estimates for 1932 were considered. The routine manufacture of tea was now in progress on the Plantation; approximately 50 lbs. per week were sold.

6. *Tobacco.* There was considerable interest in the commercial planting of low grade Indian and Ceylon tobacco and a good price was obtained in the Federated Malay States for leaf. Good growth with high grade virginian tobacco had been obtained on the Government Experimental Plantations, but a satisfactory cure was still the subject of experiment.

7. *Dairy Farm at Fraser's Hill.* Notices would shortly be posted in all Government Bungalows and the Rest House to the effect that fresh milk and vegetables could be obtained.

8. *Bark Consumption on Small Holdings.* Work on the measurement of bark consumption on small holdings had been started in the Federated Malay States, Straits Settlements and Johore and it was hoped shortly to include Kedah.

9. *Soil Erosion.* The Report on the Ceylon Committee on Soil Erosion which had been circulated to members was discussed, and the Committee decided to recommend that in Malaya a suitable combination of field works and cover crops should be employed and to record the opinion that agricultural practice in Malaya with regard to the prevention of wash was considerably in advance of that in Ceylon as disclosed by the report.

Work was reported to be in progress at Serdang on the establishment of covers on bare slopes where successful planting has in many cases proved difficult.

10. *Effect of grasses and covers on crops.* Experiments in the field and in pots in progress at Kuala Lumpur, Serdang and Klang on the effect of lallang grass and a leguminous cover on young rubber and coconut plants were described.

11. *Home Gardens.* It was decided, especially in view of the economic situation, that in 1932 an effort should be made to stimulate interest in home gardens by village competitions open to all races. A report on the successful home garden competitions recently held in the three Districts of Malacca had just been received.

Departmental.

FROM THE DISTRICTS.

The Weather.

Throughout Kedah and Province Wellesley the rainfall appears to have been less than the average fall for November and this applies generally to the inland districts of Perak. In Selangor, on the other hand, the fall was at many stations normal for the month and in some areas of Kuala Lumpur and Ulu Langat Districts exceeded the average total for November. The coastal stations of South Perak and Selangor received rather more than the usual November quota of rainfall whilst the Negri Sembilan and Malacca coasts received approximately a normal rainfall for the month. In common with the Kuala Lumpur and Ulu Langat Districts of Selangor, Seremban area received more rain than usual for November and this also applies to the Bentong, Raub and Temerloh Districts of Pahang. The rainfall for the month on the east coast was above the average, and included some very heavy downpours in 24-hours periods. At Kuala Pahang, for instance, 10.16 inches were recorded on November the 6th. and on the same date 7.34 inches were recorded at Pekan Agricultural Station.

Remarks on Crops.

Rubber.—Price quotations for the month for small-holders' rubber show the usual variations. The Penang quotation in dollars and cents per picul for small-holders' rubber ranged from $9 to $12.25 for smoked sheet and from $7 to $10 for unsmoked sheet, and quotations from most of the centres are this month very close approximations to these Penang prices, ranging from $9 to $12 for smoked sheet and $6 to $10 for unsmoked sheet.

As a result of the universal wet weather, Mouldy Rot fungus exhibited increased activity everywhere. Considering the circumstances obtaining, the measure of control attained must be considered fairly satisfactory. Although it is found impossible to clear up the disease in most places, yet most small-holders have been induced to perform more or less frequent paintings which has tended to prevent the great damage to renewing bark that takes place when Mouldy Rot receives no form of control whatever. Experiments undertaking by the Department in a locality in Selangor very badly infected with Mouldy Rot give support to the assumption that frequent paintings with a weak fungicide serve to prevent excessive drainage although eradiction of the fungus is not possible by this means, at least during wet weather and if the infection is of long standing.

Reports from the main padi-growing areas indicate that many holdings which have been out of tapping for some time are being brought into tapping again now that padi planting is finished.

Padi.—Reports from all quarters indicate that growth is generally satisfactory. In Kedah a rise of the Muda River caused total damage to about 150 acres through flood. Damage by salt water owing to high tides is reported from Kedah, Province Wellesley and the Krian District of Perak, but no extensive area was affected in any of the cases reported. The fulgorid bug, *Sogata furcifera*, is reported from Province Wellesley and most of the areas in Perak, although no extensive damage has yet been done by this pest. It is probable that lack of water movement in the Krian area, owing to the interruption to the usual irrigation arrangements, has made conditions more suitable for the increase of this bug.

Fair crops are being harvested in Selangor, although much damage is being done to ripening padi by the wet weather. An attempt is being made to get planting dates fixed at a more seasonable period than has obtained in this State for the past few years.

Requests have been received from cultivators in some areas in Selangor and Negri Sembilan for advice as to the possibility of growing a second crop during the usual inter-crop season. This matter is receiving attention.

Reports from Johore indicate that very considerably increased interest in padi planting is evinced in that State. In Muar District alone, requests for new padi land total approximately 13,000 acres.

Coconuts.—Investigations have clearly shown that the low price obtaining for copra from small holdings is intimately bound up with the poor preparation of the product and a necessary preliminary to better prices is to improve the preparation of copra. Working on this basis, an effort has been in progress for some time in Kuala Selangor District to effect improvement in this matter. Badly constructed kilns were the root of the difficulty. Two small kilns have been erected by small-holders on the advice of this Department and the copra now being produced from them is very superior to the product that has hitherto been turned out in this district. Arrangements made some time ago by the District Officer, Kuala Selangor, for improved selling arrangements of copra has enabled the owners of the newly erected kilns to obtain a price for their product which more nearly represents its true worth than they otherwise could have obtained.

Tobacco.—Little can be added to last month's summary under this heading. In North Kedah, as the result of propaganda work by the Principal Agricultural Officer, the curing of tobacco by Malays has been considerably improved. In Province Wellesley about 120 piculs of the cured leaf was prepared and sold during the month. Prices are approximately the same as those quoted last month.

Rat Control in Padi Fields.—Detailed reports received during the past few months from Krian show that the new system of control, which was introduced at the commencement of the present season, is proving a success. The present system relies for its success upon detailed frequent inspection of the whole area,

early reports of damage done and prompt attention thereto, and upon close co-operation with the headmen of the mukims and the subordinate headmen of small localities. Cultivators are now showing renewed interest in preventing damage to their crop and are tending to co-operate in preventing damage to a very much greater extent than they did under the old system, which for its success largely relied upon the payment of rewards for rats killed. The new formula for poison balls has been adopted after considerable trial and the balls now made are proving very satisfactory. In Province Wellesley the change over to the new system was not popular with the cultivators at first, but recent reports indicate progress. In Penang, where systematic control had not been introduced until this season, cultivators show great keenness to act upon the advice given them and there is a great demand for the poison balls.

Agricultural Stations and Padi Test Plots.

Kedah.—Telok Chengai Rice Station. Plants are making good growth. Examination was made of the plants raised from selected ears of local varietities for indications of hybridity. The reserve plot near the Station was planted with selected types of soya beans. His Excellency the High Commissioner and the Hon'ble the British Adviser visited the Station on the 4th. November.

Test Stations.—Plants are making good growth at all Test Stations except at Rantau Panjang where some temporary damage was done by flood water.

Gajah Mati Agricultural Station.—Fencing and levelling were completed and cover crops sown. A temporary store was erected and a short access road made to it.

Province Wellesley.—Glugor Padi Test Station. Planting was completed. Slight rat damage has occurred in one or two plots despite all precautions.

Bukit Merah Padi Test Station.—The water gate, which collapsed last month, has been repaired. Plants are making very good growth. *Sogata furcifera* has done very slight damage.

Perak.—(a) *Agricultural Station, Selama.* Erection of fence and store is well in hand and should be completed early in December. Budded kapok stems have been planted and the preparation of land for bananas is completed, four varieties having been purchased for planting. Cultivation of the pineapple plot is in hand and the nursery beds have been prepared for coffee, tobacco and other crops for which planting material is on order.

Kuala Kangsar.—Planting of the coffee area is in progress. There will be a good surplus of seedlings for sale to small-holders. Further planting of Chinese tobacco has been made. Budded kapok was planted and an improved variety of brinjal was harvested to provide a stock of seed for distribution to school gardens and to cultivators.

(b) *Padi Stations and Test Plots, Talang.*—Weeds have been very troublesome and a bad outbreak of *Sogata furcifera* occurred, first appearing in the

manurial plots. The banana area is ready for planting and only awaits the receipt of the variety Embun from Negri Sembilan.

Lenggong.—Good growth has been made and the appearance of the whole Station has considerably improved during the month.

Bruas.—The Station still has a patchy appearance due to the uneveness of the land. In certain parts, yellowing of the leaves persists. Tortoises have done some damage by nipping the plants above water level.

Bukit Gantang.—The dam again collapsed early in the month and the consequent shortage of water has favoured the growth of weeds. The shorter season varieties are making good growth. Some numbers of *Sogata furcifera* were in evidence at the end of the month.

Kamunting.—Except in Block 4 and the nursery area, the crop is making satisfactory progress, although further irrigation difficulties were again experienced owing to breaks in the main water course. The pests *Scotinophara coarctata, Nymphula depunctalis, Sogata furcifera* and stem-borers have been troublesome without having so far done very extensive damage. Tri-weekly liberations of parasites of stem-borers commenced on the 25th.

Selinsing.—Notwithstanding irregular water supply the crop is making excellent progress. The manured and deeply cultivated blocks are definitely superior in appearance to the control blocks.

Selangor.—Cheras Agricultural Station. The whole of the Station has now been finally cleared. Contour pitting of the higher part was completed and a cover crop established. Three clones of budded kapok were planted and buffalo grass has been planted along the side of a main drain to prevent erosion. Work on the buildings is still being delayed pending the decision regarding the financial provision.

Kajang Test Plot.—F. S. 27 was harvested by the pupils from the School of Agriculture. The yield was satisfactory, but actual figures are not yet available.

Kuang Test Station.—All the shorter term varieties of padi are ripening and Radin Saik was harvested at the end of the month.

Negri Sembilan.—(a) *Agricultural Station, Seremban.* The older pepper plants are producing a good quantity of fruit which is not yet ready for harvesting.

Rembau.—Fencing was completed and a propagating shed is in course of construction. Stops have been made in drains to prevent soil wash. Carpet grass and cover crops are making satisfactory growth.

(b) *Padi Test Plots. Rembau.*—Growth is very irregular. Sowings were made of a very short season variety to supply the local demand for the same.

Malacca.—(a) *Agricultural Station, Sungei Udang.* Tobacco nurseries were prepared and sown with five varieties. Yams were harvested. Good progress was made with the erection of buildings.

Pringgit.—Chiku marcots were supplied for the Singapore Station and

manuring of chiku and oranges was carried out to balance heavy marcottage.

(b) *Padi Stations and Plots.*—The Australian padi obtained last season failed to germinate. The five varieties of Italian padi recently obtained were sown. Germination was good in the case of three varieties, but indifferent in respect of the other two. Several short term varieties of padi commenced to flower.

Alor Gajah.—Weeding and rogueing was effected. Nachin and Siam varieties commenced to flower.

Pahang.—(a) *Agricultural Stations, Kuala Lipis.* Harvesting of tobacco and tapioca commenced. The soya beans, ubi kling and yam plots are making fair growth. The plots of maize which have made good growth are badly attacked by stem-borers (*Sesemia* sp.).

Temerloh.—Fencing was completed and the erection of buildings is nearly finished. A lay-out plan was drawn up and plots pegged off.

Kuantan.—Erection of buildings was completed and work is in progress on the preparation of paths and additional drains.

Pekan.—Maize, sweet potatoes and soya bean were planted. The dry padi is not making good growth, tillering is weak and weeds troublesome.

(b) *Padi Test Stations. Dong.*—Erection of a store was commenced and should be completed early next month. Short term varieties of padi have commenced to flower.

Temerloh.—Harvesting was continued under difficulties owing to the presence of water on the land. Ripening is very uneven.

Pekan.—Harvesting commenced with the reaping of the strain F. S. 27. All other varieties are in flower. The break of the monsoon will interfere with harvesting.

Singapore.—Pineapple Station. Growth of the pines still continues to be very slow and it it evident that some form of manuring will be necessary in order to obtain sufficiently healthy growth to furnish results from the experiments laid down. A small percentage of the plants have been found to be attacked by some form of "wilt" the cause of which is under investigation. Harvesting of the first crop of tobacco was completed. The results are encouraging but cannot be considered entirely satisfactory as yet. Improvements in methods of curing will be necessary in order to obtain the quality of leaf required for ready sale.

DEPARTMENTAL NOTES.

Demonstrations to Chinese Agriculturists.

On October 27th a party of 28 Chinese agriculturists from Kuala Lumpur and Sungei Balak attended a demonstration at the Government Experimental Plantation, Serdang.

As the members of the party were mainly interested in tea and tobacco, the time was almost exclusively devoted to these two crops. Particular attention was given to the method of pruning tea and in the use of cover crops and in the methods of raising tobacco plants from seed and transplanting into the field.

A further demonstration to 8 Chinese towkays from Kuala Lumpur was given on the Plantation on November 8th. Again, particular attention was given to tea and tobacco, the party being shewn the complete procedure from planting to manufacture. A visit was also made to the Stock Farm, where the Middle White pigs were greatly admired.

Attention was also given to other crops, including oil palm, coffee and pepper.

On November 20th a party of 9 Chinese agriculturists, accompanied by the Agricultural Field Officer, Selangor, attended a demonstration of rubber bud-grafting at the Rubber Research Institute Experimental Station, Sungei Buloh, Selangor. The party was greatly impressed by the method employed and its simplicity and efficiency. The manager of the station, who conducted the demonstration, was asked a number of questions, in particular relating to the objects of bud-grafting and the yields obtained.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 5th November. A résumé of the subjects discussed is included in this number.

Field work at the School of Agriculture Malaya.

That the practical side of agriculture is given sufficient prominence is evinced by the monthly reports of the Vice-Principal of the School.

Each pupil has a plot of land for the cultivation of which he is entirely responsible. In addition, various crops are cultivated on communal plots at the School. Recent work of this nature has included lining, holing and planting an area with rubber seed at stake, planting a rubber nursery and planting in baskets. Small areas have been cultivated and planted with tea, pineapples and dry padi. A coconut nursery has been established for the supplying of the School coconut area. An area has also been planted up with permanent fruit trees and with a cover crop.

Practical training this term has included a study of padi growth and pests and assistance in laying out the new Demonstration Station at Cheras.

The students also make periodical visits to the Government Experimental Plantation, Serdang, where they have recently studied tea cultivation and preparation, curing and pollination of tobacco, cleaning gingelly for the market, planting of tuba, ginger, turmeric and artichokes, contour silt-pitting and harvesting of tobacco.

Leave.

Mr. F. S. Ward, Assistant Mycologist, returned from leave of absence on 3rd October, 1931.

Mr. C. L. Newman, Agricultural Field Officer, returned from leave of absence on 7th November, 1931.

Mr. E. A. Curtler, Assistant Agriculturist, returned from leave of absence on 12th November, 1931.

Captain J. M. Howlett, M.C., Agricultural Field Officer, returned from leave of absence of 28th November, 1931.

Mr. R. G. Heath, Agricultural Field Officer, has been granted 8 months and 4 days leave on full pay with effect from the 13th November, 1931.

Statistical.

MARKET PRICES.

November, 1931.

Singapore prices of most agricultural products have generally hardened. At the end of the month it was reported that there had been a fair demand for most articles throughout the last week. Exchange went steadily against Sterling and this has hardened the value of several commodities.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 8.8 cents per lb. in November, the average London price being 2.9d. per lb. These figures are identical with the average prices for October. Fluctuations have been small, from 8⅝ cents to 9 cents and 2 7/16d. to 3d. per lb.

Palm Oil.—In the early part of November, the quotation was £20 per ton with a firm market. This improved to £21 per ton about the middle of the month. The price was maintained to the end of the month with a steady market. These prices are on the basis of 18 per cent. "F.F.A."

Copra.—Prices in November have shewn an encouraging advance on those of October. The average Singapore price in November of Sundried was $5.50 per picul as compared with $4.95 per picul in the previous month. The average price of Mixed was $4.83 per picul as compared with $4.46 in October.

Coconut Oil.—The average wholesale export price during November was $9.50 per picul. The demand for this commodity has slightly weakened, the tone of the market being dull. Copra cake averaged $2.10 per picul.

Gambier.—Block gambier has been quoted at $12 per picul nominal. Cube No. 1 has advanced to $22 per picul, the average price for the month being $21.62 as compared with $19.90 for October.

Rice.—The average wholesale price of Siam No. 2 ordinary rice, per picul in Singapore in October was $4.70 as compared with $4.14 in September. The retail market prices in October in cents per gantang of No. 2 Siam rice were Singapore 33, Penang 34, Malacca 28 as compared with 31, 32, 29 respectively in September.

Arecanuts.—Palembangs averaged $4.46 per picul, as compared with $4.55 in October. Being the beginning of the season, the goods arrived rather wet, and there is complaint that the sound quality is not as good as formerly. Bila Whole averaged $4.61 per picul against $4.25 in October. For other grades, the average prices in November were as follows:—Sliced, $9.25 to $11.75; Split, $4.75 to $6.44; Red Whole $6.87 to $7.58—all per picul, the price within each range depending upon quality. It is anticipated that the price of Red Whole will further decline. Owing to the rainy season, the new season's supply of Whole and Split are apt to be damp and the lustre less bright than in a dry season.

Coffee.—Prices of Java Robusta advanced towards the end of the month owing to small arrivals and a good demand for the Bombay market. The

average prices for the month were $16.25 to $17.88 per picul, the price between these limits depending upon quality. Corresponding prices for October were $15.10 to $17 per picul. Palembang coffee averaged $13.25 per picul in November, as compared with $12.65 per picul in October.

Pineapples.—The market became very active towards the end of the month, with sellers disposed to offer freely. Average prices per case for the month were 1½ lb. cubes, $3.74; 1½ lb. sliced flat, $3.42½; 1½ lb. sliced tall, $3.45 (nominal). Corresponding prices in October were $3.72, $3.43, $3.40 (nominal).

Tapioca.—Prices shew a decline on those of October. The following are the average prices for the month under review:—Flake, fair, $3.42; Pearl, seed, $4.59; Pearl, medium, $4.81 per picul, as compared with $3.60, $4.75 and $5.00 per picul respectively in October.

Sago.—This commodity has proved a fluctuating market, prices first advancing sharply, later becoming dull and closing with an advance, dealers having considerable outstandings and not keen to sell. The average prices for the month were:—Pearl, small, fair, $5.19 per picul, as compared with $4.78 in October; Flour, Sarawak, fair, $2.99 as compared with $2.36 in October.

Nutmegs.—Prices have stiffened considerably, supplies being short. For 110 per lb. the average price was $25.75 per picul as compared with $23.90 in the previous month; 80 per lb. $36.50 per picul as compared with $35 in October.

Mace.—Nominal prices are recorded for the month, the average being $63.75 per picul for Siouw and $48.50 per picul for Amboina, as compared with $70 and $46.40 respectively in October.

Pepper.—An improved tone is to be noted and prices have shown a small advance. The average prices in Singapore for November were:—Singapore Black, $21.81; Singapore White, $31.44; Muntok White $32.50. Corresponding prices for October were $19.90; $30.40; $31.40.

Cloves.—Nominal prices in Singapore have been quoted throughout the month. Average prices were:—Zanzibar, $46.25 per picul; Amboina, $51.25 per picul, as compared with $45 and $53.40 respectively in October.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs Cumberbatch & Co. Ltd., Kuala Lumpur; the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil mills, Singapore.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.

October, 1931.

Malaya.—The total foreign imports of rice for October 1931 amounted to 55,768 tons, as compared with 62,710 tons for the same month of last year, of which 54 per cent. were into Singapore, 20 per cent. into Penang, 7 per cent. into Malacca, 15 per cent. into the Federated Malay States and 4 per cent. into the Unfederated Malay States.

Of these imports, 55 per cent. were from Siam, 41 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

The gross foreign imports of rice into Malaya from January to October 1931 were 587,624 tons. Net imports were 446,676 tons as compared with 492,571 tons for 1930, a decrease of 9.3 per cent.

Total foreign exports of rice in October 1931 were 15,787 tons as compared with 11,739 tons in September, 1931. Of these exports, 87 per cent. went to the Netherlands East Indies and 13 per cent. to other countries.

Stocks of padi and rice held by principal dealers and millers in the Straits Settlements and Federated Malay States at the end of September 1931 amounted as declared to padi 8,198 tons and rice 34,406 tons. The estimated amount of padi and rice held by dealers and millers in the F.M.S., S.S., Johore and on estates amounted to the equivalent of 52,589 tons of rice, as compared with 63,763 tons the previous month.

The imports of rice from all sources in September were :—into the F.M.S. 17,428 tons, Johore 6,586 tons, Trengganu 1,717 tons.

Perlis exported the equivalent of 204 tons and Kedah 1,840 tons of rice in September, 1931.

Reports from all States indicate that the planting work for the new season 1931—2 is in hand in all areas.

India.—Total foreign exports of milled rice during January to September, 1931 were 1,671,000 tons, a decrease of 568,000 tons or 25.4 per cent. as compared with the corresponding period of 1930, and a decrease of 239,000 tons or 12.5 per cent. of the past six years.

The First Forecast of the Rice Crop in Burma for the season 1931—2 issued on October 10, 1931 gives the area likely to mature as 12,203,100 acres, being 394,900 acres or 3 per cent. less than the final figures of last season.

Burma exports of rice and rice products (including exports to India) from January 1 to October 17, 1931, were 3,028,270 tons an increase of 3,822 tons over the corresponding period of 1930.

Japan.—According to the first rice-crop forecast for 1931, the area planted is estimated to be 7,949,404 acres, a slight increase over the previous year, and the yield at 8,129,775 tons, a decrease of 13.3 per cent. as compared with 1930.

China.—Manchuria. According to the International Crop Report, Rome, dated September 1931, the total area of padi and upland rice sown this year is 502,000 acres, an increase of 37,000 acres or 8 per cent. as compared with 1930. The total production in 1931 is estimated at 332,140 tons, an increase of 24,860 tons (8 per cent.) as compared with 1930.

Siam.—Exports of rice from Bangkok, (as reported by official sources) for the 10 months ending September 1931, were 991,773 tons, an increase of 80,050 tons or 8.8 per cent. as compared with the corresponding period of 1930, but a decrease of 159,078 tons or 13.8 per cent. as compared with the average of the corresponding period of the past five years.

Netherlands East Indies.—At the end of September 1931, the area harvested was reported to be 8,057,791 acres, a decrease of 158,062 acres (1.9 per cent.) as compared with 1930; the area damaged 402,549 acres, an increase of 185,580 acres or 85.5 per cent. as compared with 1930, and the area standing 926,275 acres, an increase of 48,585 acres or 5.5 per cent. as compared with 1930.

While the area harvested in Java and Madura was less than in 1930, the area planted and harvested is above the average of the years 1921—30.

Imports into Java and Madura January to September 1931 were 226,990 tons as compared with 215,947 tons for 1930, and in the Outer Provinces, January to August 1931 were 224,907 tons as compared with 254,291 tons for the same period of 1930.

French Indo-China.—Entries of padi at the port of Cholon for the first 10 months of 1931 were 964,291 metric tons, a decrease of 105,514 metric tons or 10 per cent. as compared with the same period of 1930.

Exports of rice from Saigon (January 1 to October 31, 1931) were 841,974 metric tons, a decrease of 129,588 metric tons (13.3 per cent.) as compared with the corresponding period of 1930.

The padi market in September was dull with a tendency to weaken owing to lack of demand. The stock at Cholon are high in comparison with the amount of business done.

The rice market for September was quiet. The market closed firm with considerable stocks at Cholon.

Ceylon.—Imports for 9 months ending September 30, 1931 were 330,224 tons a decrease of 20,601 tons or 5.9 per cent. as compared with the corresponding period of 1930, and a decrease of 13,435 tons or 3.9 per cent. as compared with the average of the same period during the last five years.

Europe.—To Europe, period January 1 to October 15, 1931 were shipped 946,186 tons as compared with 642,071 tons for the corresponding period of 1930.

To the Levant, period January 1 to September 11, 1931 were shipped 53,160 tons, an increase of 35,852 tons as compared with the same period of 1930.

To the West Indies, period January 1 to September 1, the shipment from the East were 119,805 tons, a decrease of 27.6 per cent. as compared with the same period of the previous year.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1931.

PRODUCT	NET EXPORTS IN TONS.				
	1930	Jan 1—Aug. 31st, 1930	Jan 1—Aug. 31st, 1931	September, 1930	September, 1931
Coconut, fresh ...	10,475	6,858	5,326	996	840
Copra ...	102,014	56,559	60,774	9,948	10,054
Coconut Oil ...	9,475	6,319	6,640	948	772
Palm Oil ...	3,211	1,743	2,314	422	440
Palm Kernels ...	485	266	324	54	87
Pineapples, canned ...	57,689	44,728	45,334	2,237	1,782
Tapioca ...	31,195	21,120	19,788	2,392	2,153
Arecanuts ...	23,254	17,287	13,049	1,261	1,718
Tuba root ...	55½	—	46	—	3½

NETHERLANDS EAST INDIES AREAS OF PRODUCTIVE RUBBER UNTAPPED.

The following figures of productive rubber areas untapped are supplied by the Central Bureau of Statistics, N.E.I., Batavia and represent the acreages of tappable rubber on estates in the Netherlands East Indies which had entirely ceased tapping on November 25, 1931. Statistics regarding untapped areas on estates that have partly ceased tapping are not available.

	Number of Estates.	Total in acres.	Of which Mature rubber in acres.	In % of Totals productive planted areas 1930.	Production 1930 in Tons.
Java ...	(A) 79	68,908	29,482	8.4	3,653
	(B) 5	6,988	2,957		392
Outer Provinces ...	(A) 35	30,146	17,828	3.5	2,130
	(B) 8	1,522	773		112
Netherlands Indies ...	(A) 114	99,054	47,310	5.6	5,783
	(B) 13	8,509	3,730		504

(A) = rubber estates where tapping has been stopped, but which are still kept in running condition.

(B) = estates which are entirely or practically abandoned.

RUBBER AREAS UNTAPPED IN OCTOBER, 1931, IN THE FEDERATED MALAY STATES AND STRAITS SETTLEMENTS.

(Estates of 100 acres and over).

State or Territory	Area out of Tapping		Total area Untapped*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres.	Acres.	Acres.
Perak ...	8,302	28,468	36,770
Selangor ...	13,512	39,812	53,324
Negri Sembilan ...	15,093	25,731	40,824
Pahang ...	6,751	5,421	12,172
Total F.M.S. ...	43,658	99,432	143,090
Province Wellesley ...	3,169	7,900	11,069
Dindings ...	217	1,679	1,896
Malacca ...	4,646	18,118	22,764
Penang ...	747	137	884
Singapore ...	10,512	5,219	15,731
Total S.S. ...	19,291	33,053	52,344
Grand Total ...	62,949	132,485	195,434

*Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. & S.S. during October (not included in the above figures) were :—
F.M.S. 39,558 acres, S.S. 11,513 acres, Total 51,071 acres.

AREA OF "TAPPABLE" RUBBER UNTAPPED IN SEPTEMBER AND OCTOBER IN JOHORE AND KEDAH.

State	Area Untapped (Acre)				Total area untapped (b)	
	Estates which have entirely ceased tapping		Estates which have partly ceased tapping			
	Sept.	Oct.	Sept.	Oct.	Sept.	Oct.
Johore ...	24,411	22,985	48,364	46,092	72,775	69,077
Kedah ...	14,298 (a)		15,445 (a)		29,743 (a)	

(a) Kedah Returns refer to lands owned by Registered Companies only, and are rendered quarterly, commencing with June, 1931.

(b) Areas rested due to rotational tapping system are not included in the above table. The figures of areas untapped owing to rotational tapping system were for Kedah at the end of September 42,769 acres; Johore, end of September 31,751 acres, and end of October 32,112 acres.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF OCTOBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1931	during the month	during the year 1931	during the month		during the year 1931		during the month		during the year 1931		Ports	Dealers	Estates of 100 acres and over
								Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,065	13,760	12,193	11,282	8,573	85,918	Nil	Nil	Nil	26	14,851	7,605	132,962	73,864	...	12,056	11,5[illegible]
Johore	...	2,356	3,764	3,845	35,617	3,885	37,931	Nil	Nil	Nil	19	1,606	6,899	8,138	66,227	..	2,5[illegible]	3,636
Kedah	...	450	3,270	2,379	21,191	1,231	10,561	Nil	Nil	Nil	Nil	558	3,017	6,184	26,022	...	423	2,173
Perlis	...	22	6	4	64	3	94	Nil	Nil	Nil	Nil	Nil	7	Nil	151	...	22	6
Kelantan ...	...	160	93	186	1,761	471	3,816	43	Nil	86	Nil	96	539	708	5,051	...	210	108
Trengganu ...	..	55	50	118	1,038	59	519	Nil	Nil	Nil	Nil	Nil	177	Nil	1,557		55	50
Total Malay States		15,107	19,163	18,725	170,953	14,[illegible]	138,[illegible]	43	Nil	86	45	16,300	18,244	147,992	172,972	...	15,086	17,931
STRAITS SETTLEMENTS																		
Malacca ...	...	2,955	1,480	1,503	12,700			Nil		Nil		4,562		44,250		...	2,688	1,364
Province Wellesley		122	512	491	4,625	62	589	Nil		Nil						...	169	57[illegible]
Dindings ...	...	95	125	106	962	2,168	20,484	Nil	18,248	Nil	173,399	5,976	Nil	60,415	Nil	...	105	134
Penang	1,824	2,927	7	8	75			492		5,871						2,109	4,279	9[illegible]
Singapore ...	5,833	32,313	282	169	1,761			7,591		79,318		18,868		183,235		9,516	32,916	279
Total Straits Settlements	7,657	35,411	2,366	2,366	20,123	2,168	20,484	8,626	18,[illegible]	85,[illegible]	173,399	29,406	Nil	287,900	Nil	11,625	39,497	2,36[illegible]
TOTAL MALAYA	7,657	53,489	22,026	21,591	191,076	16,283	159,323	8,126	18,291	85,275	173,444	45,911	18,244	435,892	172,972	11,625	54,583	20,297

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	Selangor	Penang	Province Wellesley D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	9,510	29,367	3,924	2,712	884	46,397
WET RUBBER	2,546	2,949	355	190	1,434	7,474
TOTAL ...	12,056	32,316	4,279	2,902	2,318	53,871

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	29,270	283033
Penang ...	10,317	99,311
Port Swettenham.	5,753	49,514
Malacca ...	571	3,979
MALAYA ...	45,911	435,837

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	38,442	350,67[illegible]
Straits Settlements		
MALAYA ...	38,14[illegible]	350,67[illegible]

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st November, 1931.

METEOROLOGICAL SUMMARY, MALAYA, OCTOBER, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	88.9	72.0	80.5	93	69	81	74	83.3	84.5	9.69	246.1	1.86	19	15	5	4	2	142.90	4.61	38
Bukit Jeram, Selangor ...	87.8	74.4	80.1	91	69	79	75	84.5	86.3	5.03	127.8	1.35	16	15				167.55	5.40	45
Sitiawan, Perak ...	89.9	73.1	81.5	94	70	85	75	84.8	85.1	7.60	193.1	2.77	19	16	1	1		186.15	6.00	
Kroh, Perak ...	84.3	69.7	77.0	88	67	74	72	80.5	82.1	13.97	354.9	2.10	25	23	1	2		155.80	5.03	
Temerloh, Pahang ...	89.6	72.6	82.9	95	70	76	75	85.0	86.1	5.11	129.8	3.16	13	9	2	8		148.60	4.79	39
Kuala Lipis, Pahang ...	88.6	71.5	80.1	94	69	78	73	83.4	84.4	7.69	195.3	1.54	15	12	12	16	1	135.10	4.36	36
Kuala Pahang, Pahang ...	87.0	74.7	80.9	91	72	80	77	83.7	86.0	16.07	408.2	5.55	20	17	2			143.55	4.63	38
Mount Faber, Singapore ...	86.6	75.1	80.9	91	72	80	79	81.8	83.3	9.21	233.9	1.79	17	15	1			154.00	4.97	41
Butterworth, Province Wellesley ...	86.2	74.3	80.3	89	72	80	77	83.9	85.2	13.13	333.5	2.41	23	21			1	166.85	5.38	
Bukit China, Malacca ...	84.9	73.8	79.3	87	71	81	77	82.9	84.2	7.23	183.7	1.98	20	15				176.25	5.69	47
Kluang, Johore ...	87.9	71.8	79.9	93	69	80	74	82.0	82.6	3.40	86.4	0.85	12	8	2	4		126.25	4.07	34
Bukit Lalang, Mersing, Johore	88.1	72.1	80.1	93	70	81	74	79.8	79.9	6.46	164.1	2.03	13	12	2			151.55	4.89	40
Alor Star, Kedah ...	85.9	74.0	79.9	90	72	77	76	85.0	85.8	17.62	447.7	3.32	20	20			1	165.95	5.35	45
Kota Bahru, Kelantan ...	87.1	73.4	80.3	92	71	77	75	83.5	85.4	24.20	614.7	6.73	18	16	2	1		164.35	5.30	44
Kuala Trengganu, Trengganu	86.4	73.0	79.7	92	69	76	75	83.1	84.5	32.23	818.7	15.79	27	20	11			141.95	4.58	38
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	70.4	58.9	64.7	75	56	62	61			15.19	385.8	2.16	21	19	1	4	3	122.35	3.95	33
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.9	57.9	64.4	74	52	64	62	69.4	69.8	14.36	364.7	1.91	22	22	1	3		124.60	4.02	33
Fraser's Hill, Pahang 4268 ft.	73.1	61.8	67.5	77	59	65	64	74.3	71.2	9.11	231.39	1.35	23	20	1	17	4	123.40	3.98	33

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